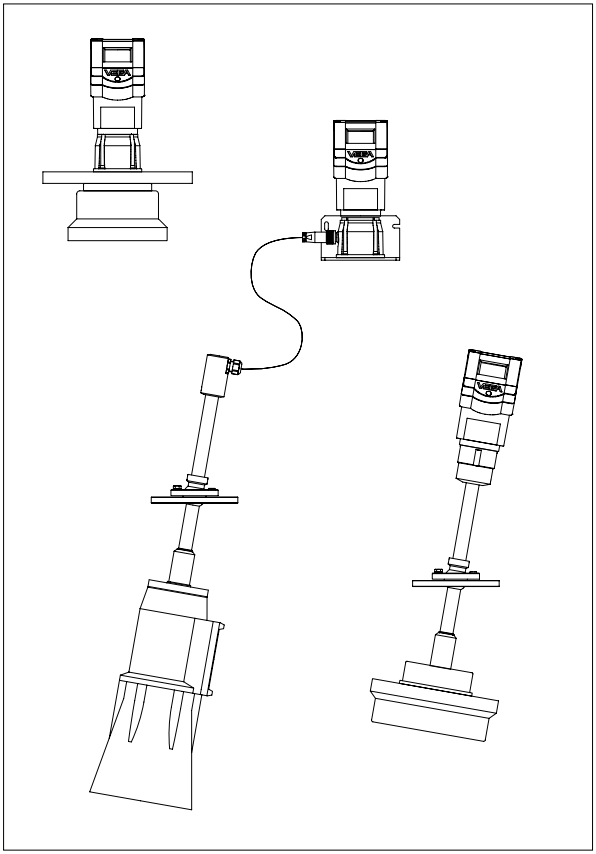
Level and Pressure

Operating Instructions

VEGASON 54V ... 56V



Contents

Safety information

Please read this manual carefully, and also take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

For safety and warranty reasons, any internal work on the instruments, apart from that involved in normal installation and electrical connection, must be carried out only by qualified VEGA personnel.

Note Ex area

Please note the approval documents (yellow binder), and especially the included safety data sheet.

1 Product description

1.1 Function

Continuous level measurement with ultrasonic sensors is based on the running time measurement of ultrasonic pulses.

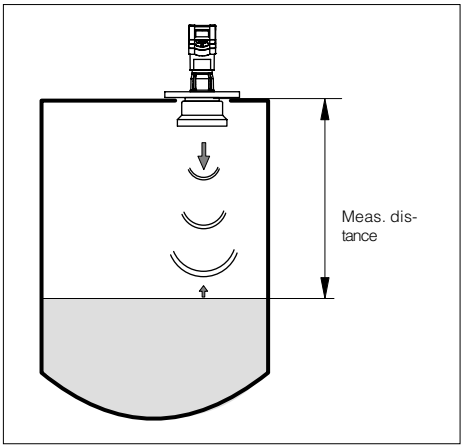
VEGASON series 54 ... 56 sensors are a newly developed generation of extremely compact ultrasonic sensors for level measurement. They were especially developed for solids and larger measuring ranges. Preferred areas of application are silos, bunkers or material heaps.

Due to the small housing dimensions and process fittings, the compact sensors are a very reasonable solution for your level measurement applications. With the integrated display and a special sensor intelligence, in conjunction with large measuring ranges, they can be used for applications in which the advantages of a non-contact measurement could never before be realized.

As output or measuring signal, the instruments produce a digital output signal which is further processed in the VEGAMET signal conditioning instrument or in the VEGALOG processing system.

Measuring principle

Piezoceramic high performance transducers emit focused ultrasonic pulses which are reflected by the product surface. The measurement electronics prepares a precise picture of the environment out of the reflected ultrasonic pulses. The transducers work both as transmitter and receiver. As receiver, the transducers are high-sensitivity piezo microphones.



emission - reflection - reception

The measurement electronics precisely calculates the distance between transducer and medium from the speed of sound and the measured running time of the emitted sound impulse. The distance is then converted into a level proportional signal, and in conjunction with the sensor parameter settings, made available as precise, calibrated level value.

Since the speed of sound is subjected to a temperature influence, the transducer also continuously detects the ambient temperature, so that the level is precisely measured even in case of varying ambient temperature.

Output signal

The level-proportional measuring signal is processed and outputted completely digitally. The digital processing of the measuring signal ensures an accuracy which could be never reached by an analogue measuring signal, as the digital signal is always transmitted up to the last decimal point.

Varying line resistances or smallest leakage currents do not influence the accuracy of the digital technology. Even in case of failure, the digital signal is always clear.

The parameter setting of the digital signal is individual and represents the adjusted measuring range of the sensor.

Display of measured values

As an option, the series 50 ultrasonic sensors can be equipped with an indicating instrument for direct, local level survey. The indicating instrument shows the precise level by means of the analogue bar graph and the digital number value. In addition to the indication in the sensor, you can have the level displayed with the VEGADIS 50 external indicating instrument at a distance of up to 25 m from the sensor. The external display of measured values operates, like the integrated display, independently of the output signal, can be modified through individual parameter settings, and is powered by the sensor.

1.2 Application features

Applications
- Level measurement of all liquids.
- Level measurement of solids such as e.g. coal, ore, stones, stone dust, cement, gravel, crushed stones, sand, sugar, salt, cereals, flour, granules, powder, dust, sawdust, wood chips.
- Flow measurement on various flumes.
- Gauge measurement, distance measurement, object monitoring and conveyor belt monitoring

Voltage supply
- Supply and output signal via one two-wire cable (loop powered) from the VEGAMET signal conditioning instrument or from the VEGALOG processing system.

Rugged and precise
- Measurement unaffected by substance properties such as density, conductivity, dielectric constant…
- Suitable for corrosive substances
- Measuring range 0.8 m … 70 m
- Precise by digital processing and output of measured values.

Means of adjustment
- With adjustment software VEGA Visual Operating (VVO) on the PC
- With detachable adjustment module MINICOM
- With VEGAMET signal conditioning instrument.

Display of measured value
- Display module integrated in sensor
- Optional display module separated from sensor

Process fittings
- G 1 A, DN 50, DN 80, DN 200, DN 250

Approvals
- CENELEC, ATEX, PTB, FM, CSA, ABS, LRS, GL, LR, FCC

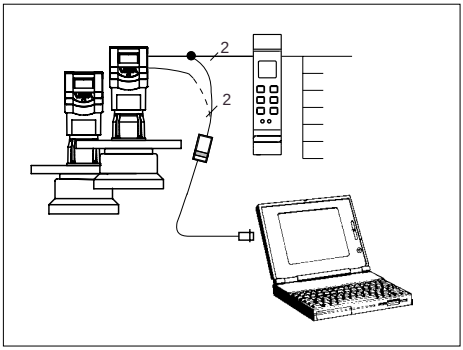
1.3 Adjustment

Each measuring situation is unique. For that reason, every ultrasonic sensor needs some basic information on the application and the environment, e.g. an empty vessel profile is important for a reliable measurement. Beside this, many other settings and adjustments are possible on VEGASON ultrasonic sensors.

The adjustment and parameter setting of ultrasonic sensors are carried out with
- the PC
- the detachable adjustment module MINICOM
- the VEGAMET 514V or VEGAMET 515V signal conditioning instrument

Adjustment with PC

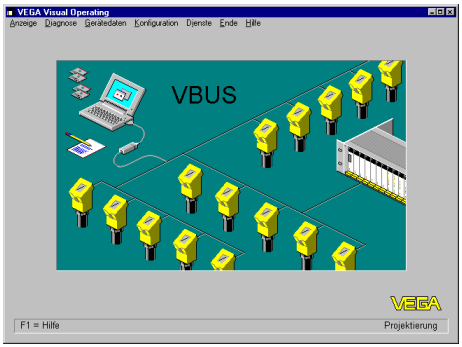
The setup and adjustment of the ultrasonic sensors is generally done on the PC with the adjustment program VEGA Visual Operating (VVO) under Windows®. The program leads quickly through the adjustment and parameter setting by means of pictures, graphics and process visualisations.



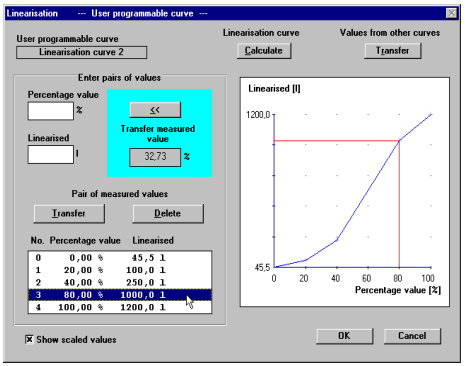
Adjustment with the PC to the digital signal and supply cable between the sensors and the VEGAMET signal conditioning instrument or on the sensor itself

The PC can be connected to any individual position of the system or the signal cable. It is connected by means of the two-wire PC interface converter VEGACONNECT 2 to the sensor, the signal cable or to the signal conditioning instrument or directly with a standard cable (RS 232) to the VEGALOG processing system.

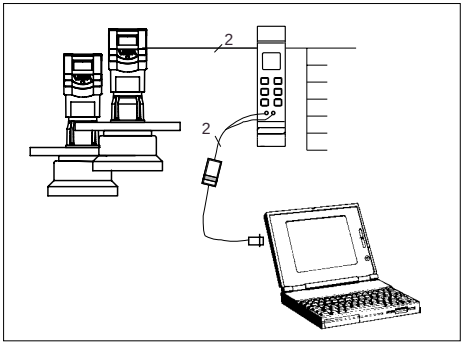
The adjustment and parameter data can be saved with the adjustment software on the PC and can be protected by passwords. On request, the adjustments can be quickly transferred to other sensors.



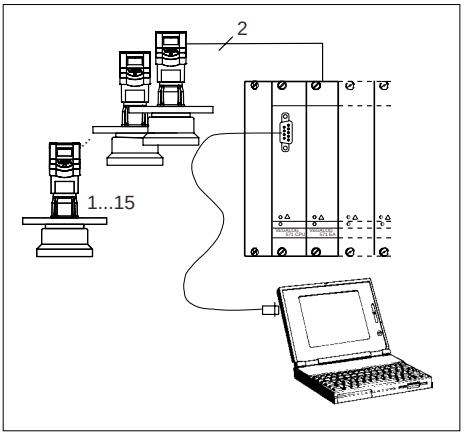
The adjustment program recognises the sensor type and the mounting location



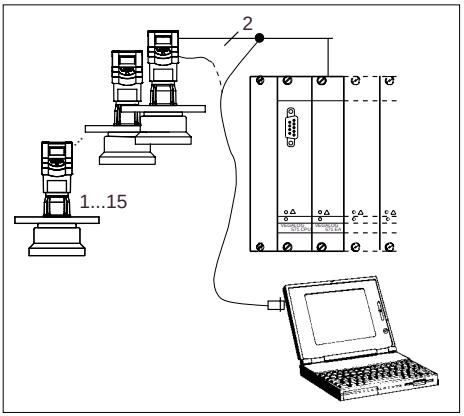
Visualised input of a vessel linearisation curve



Adjustment with the PC on the VEGAMET 515V signal conditioning instrument (two sensors) or 514V (one sensor)



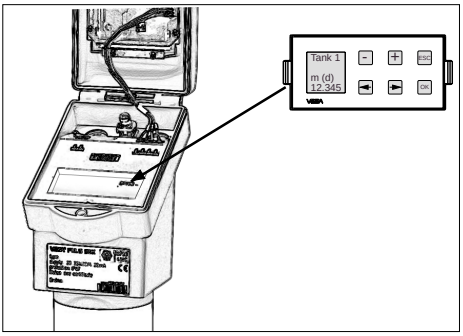
Adjustment with the PC on the VEGALOG processing system with the standard cable RS 232 (on the processing system it is possible to operated up to 15 sensors on one two-wire cable)



Adjustment on the digital signal and supply cable to the VEGALOG 571 processing system or directly on the sensor

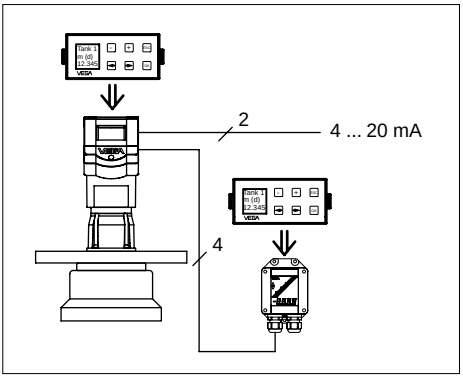
Adjustment with adjustment module MINICOM

With the small (3.2 cm x 6.7 cm) 6-key adjustment module with display, the adjustment can be carried out in clear text dialogue.



Detachable adjustment module MINICOM

The adjustment module can be plugged into the ultrasonic sensor or into the optional, external indicating instrument.

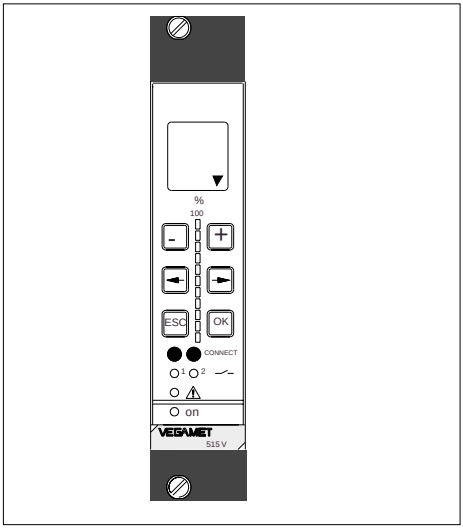


Adjustment with detachable adjustment module. The adjustment module can be plugged into the ultrasonic sensor or the external indicating instrument VEGADIS 50.

Unauthorised sensor adjustments can be prevented by removing the adjustment module.

Adjustment with VEGAMET signal conditioning instrument

The ultrasonic sensors with digital output signal can be operated beside the PC also with the VEGAMET signal conditioning instrument.



6-key adjustment field on the instrument front of the VEGAMET signal conditioning instrument

For adjustment, the digital VEGAMET 514V and 515V signal conditioning instruments are equipped with a 6-key adjustment field with display. There the parameter setting can be done in clear text dialogue. The adjustment structure corresponds to the adjustment on the adjustment module MINICOM.

2 Types and versions

2.1 Type survey

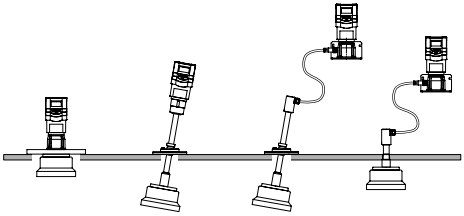
VEGASON series 54 ... 56 sensors are a newly developed generation of extremely compact ultrasonic sensors for large measuring ranges. VEGASON 51 ... 53 are used for shorter measuring ranges.

Due to the small housing dimensions and process fittings, the compact sensors do your level monitoring inconspicuously, and above all, at reasonable cost. Swivelling holders allow a quick alignment of the transducer to the product and solid surface. Mounting is simplified by the option of separating the sensor electronics from the transducer. The sensor electronics can be mounted at a distance of 300 m from the transducer. It is then possible to mount the transducer in environments with an ambient temperature up to 150°C.

Common features

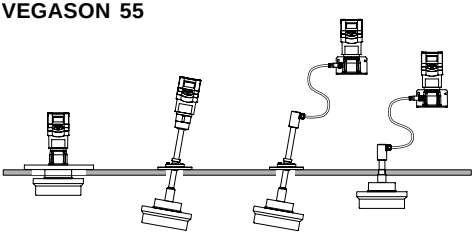
- Four versions (A ... D).
- Application is solids and liquids.
- Measuring range 0.8 m ... 70 m.
- Ex approved in zone 1 (IEC) or zone 1 (ATEX) classification mark EEx ia [ia] IIC T6.
- Integrated display of measured values in the sensor or in the external indicating instrument separated up to 25 m from the sensor.

VEGASON 54



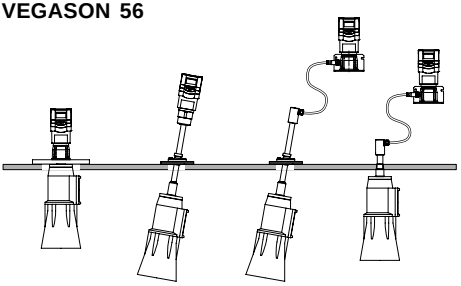
version A version B version C version D

VEGASON 55



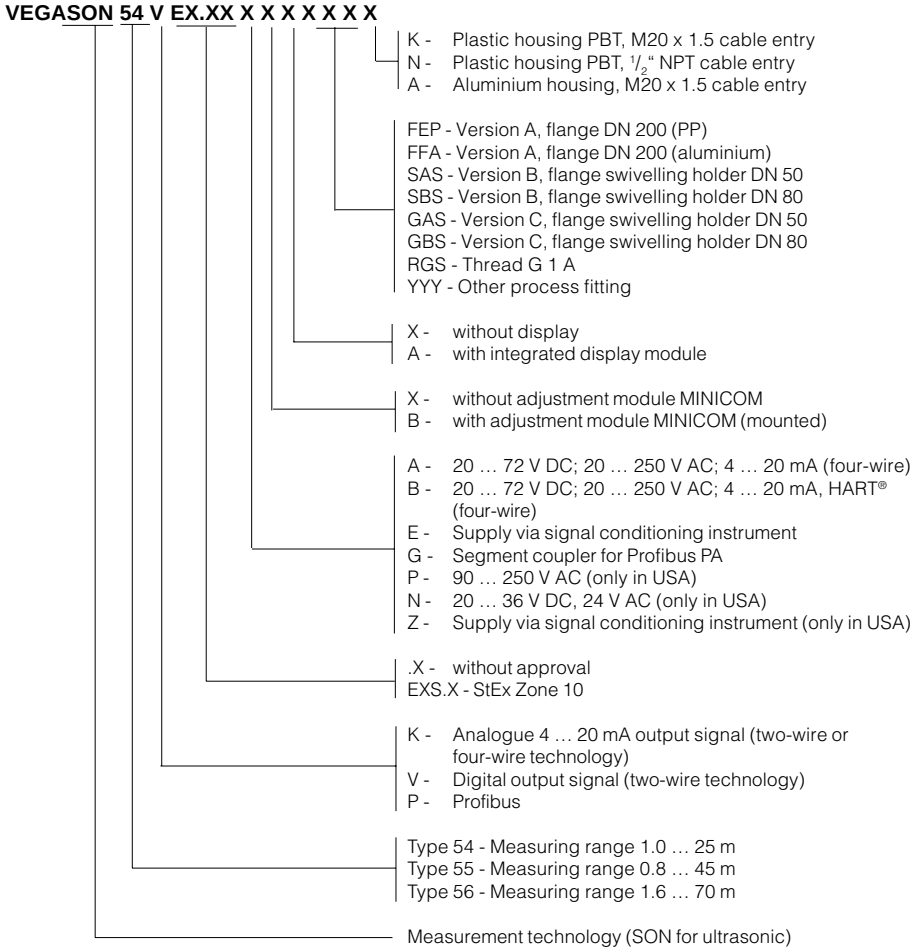
version A version B version C version D

VEGASON 56



version A version B version C version D

2.2 Type code


VEGASON 54 V EX.XX X X X X X X X
K - Plastic housing PBT, M20 x 1.5 cable entry
N - Plastic housing PBT, 1/2" NPT cable entry
A - Aluminium housing, M20 x 1.5 cable entry
FEP - Version A, flange DN 200 (PP)
FFA - Version A, flange DN 200 (aluminium)
SAS - Version B, flange swivelling holder DN 50
SBS - Version B, flange swivelling holder DN 80
GAS - Version C, flange swivelling holder DN 50
GBS - Version C, flange swivelling holder DN 80
RGS - Thread G 1 A
YYY - Other process fitting
X - without display
A - with integrated display module
X - without adjustment module MINICOM
B - with adjustment module MINICOM (mounted)
A - 20 … 72 V DC; 20 … 250 V AC; 4 … 20 mA (four-wire)
B - 20 … 72 V DC; 20 … 250 V AC; 4 … 20 mA, HART® (four-wire)
E - Supply via signal conditioning instrument
G - Segment coupler for Profibus PA
P - 90 … 250 V AC (only in USA)
N - 20 … 36 V DC, 24 V AC (only in USA)
Z - Supply via signal conditioning instrument (only in USA)
.X - without approval
EXS.X - StEx Zone 10
K - Analogue 4 … 20 mA output signal (two-wire or four-wire technology)
V - Digital output signal (two-wire technology)
P - Profibus
Type 54 - Measuring range 1.0 … 25 m
Type 55 - Measuring range 0.8 … 45 m
Type 56 - Measuring range 1.6 … 70 m
Measurement technology (SON for ultrasonic)

2.3 Approvals

When using ultrasonic sensors in Ex areas or in marine applications, the instruments must be suitable and approved for the explosion zones and application areas.
The suitability is tested by approval authorities and is certified in approval documents.

VEGASON 50 ultrasonic sensors are approved for Ex zone 1, 10, 11, 21 and 22. Please note the attached approval documents when using a sensor in Ex area.

2.4 Configuration of measuring systems

A measuring system consists of a sensor and a processing unit. The processing unit (the VEGAMET signal conditioning instrument or the VEGALOG processing system) evaluates the level-proportional digital measuring signals in a number of processing routines and outputs the levels as individual current, voltage or switching signals.

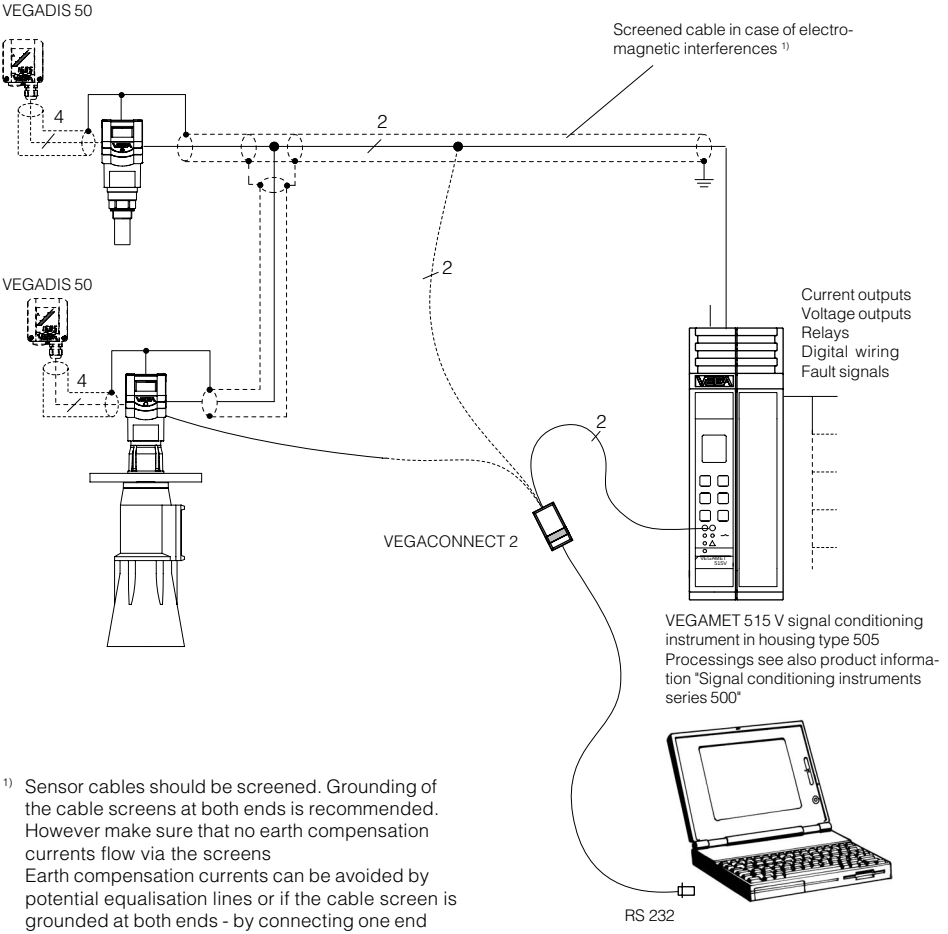
Two sensors can be connected via one two-wire cable to the VEGAMET 515V signal conditioning instrument. Up to 255 sensors can be connected to the VEGALOG 571 processing system. 15 sensors (loop powered) on one two-wire cable.

Beside the output of the levels in percent, cubicmeters or other physical units, also current, voltage or switching signal (relay or transistor), the levels can be also processed by linked processing algorithms. Scaling, linearisation, calculation of linearisation curves, differential generation, addition or tendency processing are fixed implemented as processing routines in the VEGALOG processing systems and VEGAMET and are easily accessible via the menu.

On the following pages you find examples of two different instrument configurations (measuring systems) consisting of sensor(s) and processing system.

1 ... 2 sensors on VEGAMET 515V signal conditioning instrument

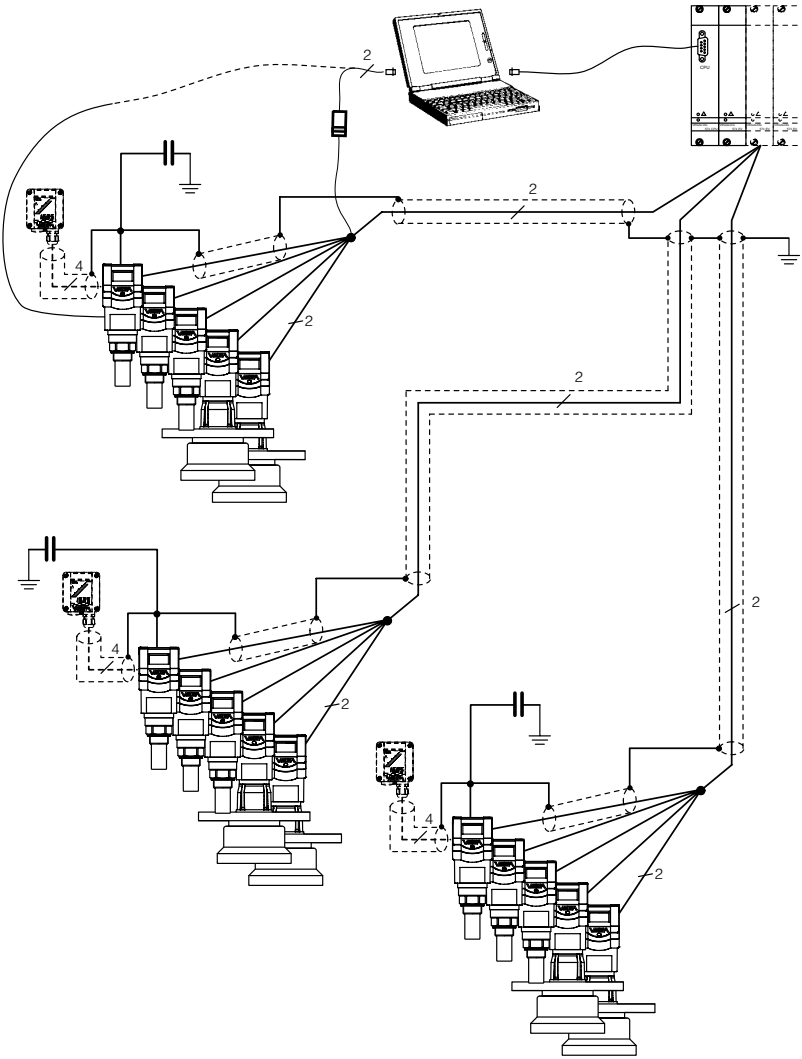
- Two-wire technology, supply from the signal conditioning instrument, output signals and voltage supply via one two-wire cable.
- Digital output signal, two sensors on one cable.
- Display of measured values in the sensor and in the signal conditioning instrument.
- Optional external indicating instrument (can be mounted up to 25 m separated from the sensor in Ex area).
- Adjustment with the PC, the signal conditioning instrument or adjustment module MINICOM (can be plugged into the sensor or the external indicating instrument VEGADIS 50).
- Max. resistance of the signal cable 15 Ω per wire or 1000 m cable length.



1) Sensor cables should be screened. Grounding of the cable screens at both ends is recommended. However make sure that no earth compensation currents flow via the screens
Earth compensation currents can be avoided by potential equalisation lines or if the cable screen is grounded at both ends - by connecting one end (e.g. in the switching cabinet) via a capacitor (e.g. 0.1 µF; 250 V) to earth potential.

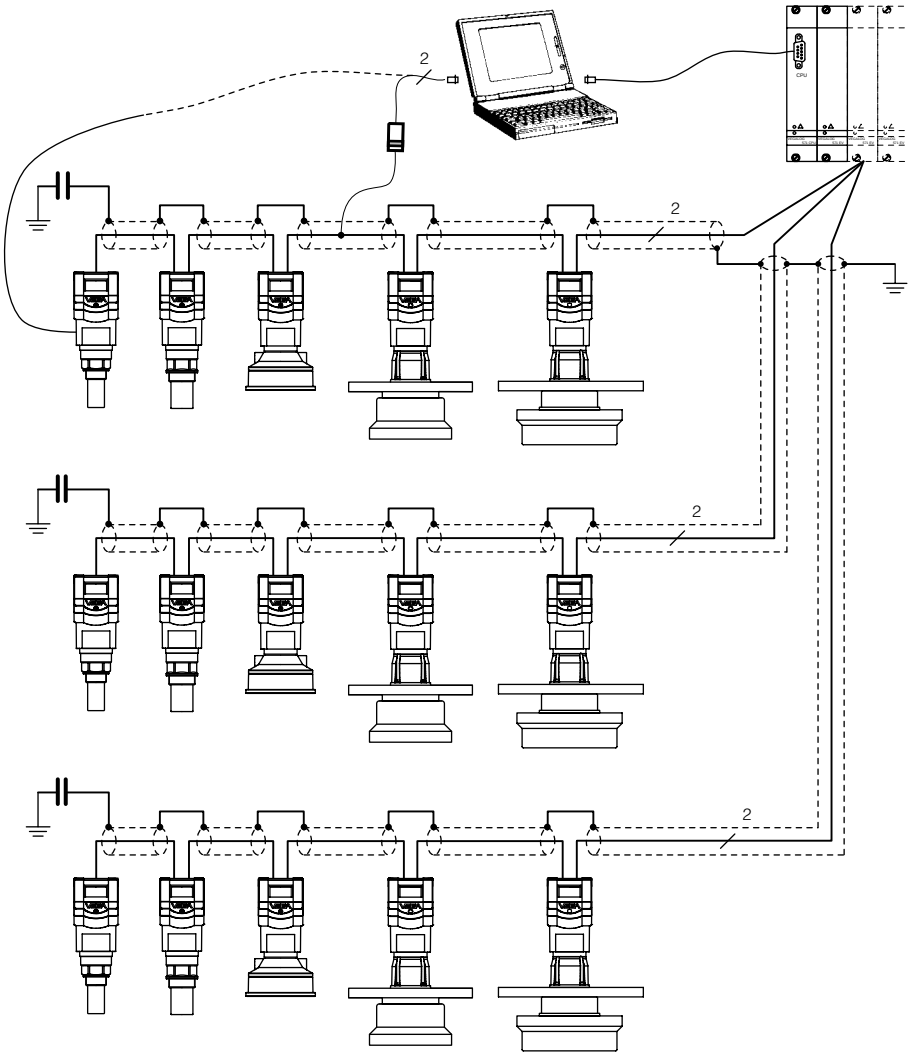
5 sensors per two-wire cable in radial configuration on the VEGALOG 571 processing system

- 15 sensors with voltage supply and digital output signals via three two-wire cables on one input card of the VEGALOG 571 processing system.
- Display of measured value integrated in the sensor.
- Optional external indicating instrument (can be mounted up to 25 m separated from the sensor in Ex area).
- Adjustment with the PC or adjustment module MINICOM (can be plugged into the sensor or the external indicating instrument VEGADIS 50).
- Max. resistance of the signal cable 15 Ω per wire or 1000 m cable length.



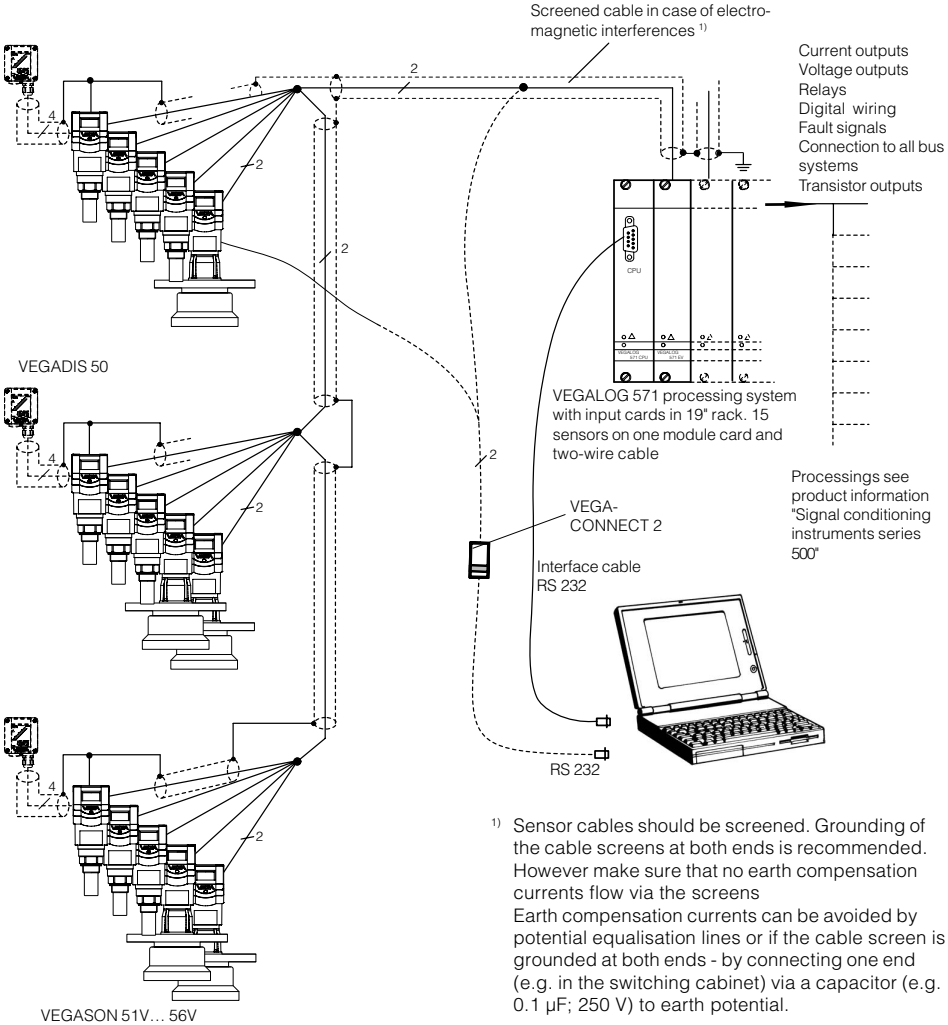
5 sensors per two-wire cable in linear configuration on the VEGALOG 571 processing system

- 15 sensors with voltage supply and digital output signals via three two-wire cables on the input card of the VEGALOG 571 processing system.
- Display of measured values integrated in the sensor.
- Optional external indicating instrument (can be mounted up to 25 m separated from the sensor in Ex area).
- Adjustment with the PC or adjustment module MINICOM (can be plugged into the sensor or the external indicating instrument VEGADIS 50).
- Max. resistance of the signal cable 15 Ω per wire or 1000 m cable length.



15 sensors via one two-wire cable on the VEGALOG 571 processing system

- 15 sensors with voltage supply and digital output signals via one two-wire cable on an input card of the VEGALOG 571 processing system.
- Display of measured values integrated in the sensor.
- Optional external indicating instrument (can be mounted up to 25 m separated from the sensor in Ex area).
- Adjustment with the PC or adjustment module MINICOM (can be plugged into the sensor or in the external indicating instrument VEGADIS 50).
- Max. resistance of the signal cable with 15 sensors on one two-wire cable 10 Ω per wire (instead of 15 Ω) or 1000 m cable length.



1) Sensor cables should be screened. Grounding of the cable screens at both ends is recommended. However make sure that no earth compensation currents flow via the screens
Earth compensation currents can be avoided by potential equalisation lines or if the cable screen is grounded at both ends - by connecting one end (e.g. in the switching cabinet) via a capacitor (e.g. 0.1 µF; 250 V) to earth potential.

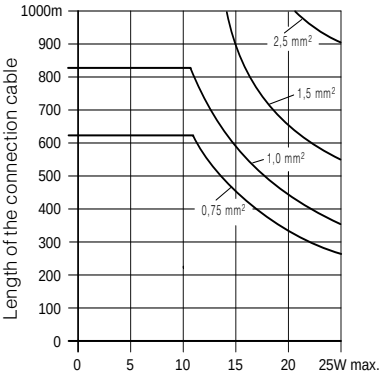
3 Technical data

3.1 Data

Power supply

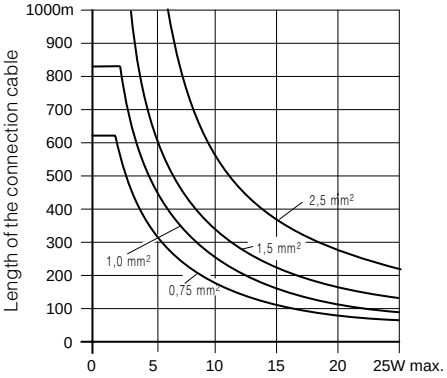
Supply voltage	is sensor supply is made from the signal conditioning instrument VEGAMET, the processing system VEGALOG or the processing system VEGASCAN 850 (1 … 15 sensors on one two-wire cable)
Min. sensor voltage	17 V
Power consumption	max. 1.5 W
Current consumption	90 mA
Load (signal and supply cable)	depending on the connected sensor power per connection cable, see following load diagrams, however max. 15 Ω per wire or max. 1000 m cable length

Supply from processing system VEGASCAN 850



Total power of all sensors on one two-wire cable

Supply from signal conditioning instrument VEGAMET or processing system VEGALOG



Total power of all sensors on one two-wire cable

Measuring range

(reference plan for sensor version B ... D is the transducer end. For sensor version A, the lower flange edge is the reference plane)

VEGASON 54	1.0 … 25 m
VEGASON 55	0.8 … 45 m
VEGASON 56	
- version A	1.8 … 70 m
- version B … D	1.4 … 70 m

Output signal

Signal output	digital output signal in two-wire technology (VBUS): the digital output signal (meas. signal) is modulated to the power supply and is further processed in the signal conditioning instrument or in the processing system
Load	resistance per signal cable max. 15 Ω per wire or max. 100 m cable length
Integration time	0 … 999 seconds (adjustable in the sensor) 0 … 600 seconds (adjustable in the signal conditioning instrument)

Display of measured values (optional)

Liquid crystal display	
- in the sensor	scalable measured value output as graph and numerical value
- powered externally by the sensor	scalable measured value output as graph and numerical value. The display module can be mounted up to 25 m away from the sensor.

Adjustment

- PC with adjustment software VEGA Visual Operating
- Adjustment module MINICOM

Accuracy [1]

(typical values under reference conditions, all statements relate to the nominal measuring range)

Characteristics	linear
Deviation in characteristics including linearity, reproducibility and hysteresis (determined by limit point methods)	< 0.1 %
Linearity	better than 0.05 %
Average temperature coefficient of the zero signal	0.06 %/10 K
Resolution in general	max. 1 mm
Resolution of the output signal	0.01 % or 1 mm
Adjustment time [2]	
- VEGASON 54	> 2 s (depending on parameter adjustment)
- VEGASON 55, 56	> 4 s (depending on parameter adjustment)

[1] Similar to DIN 16 086, references conditions acc. to IEC 770;
Temperature 15°C … 35°C; moisture 45 % … 75 %; air pressure 860 mbar … 1060 mbar

[2] The adjustment time is the time the sensor requires to output the level correctly in case of a quick level change (with max. 10 % deviation).

Characteristics [1)]

(typical values under reference conditions, all statements relate to the nominal measuring range)

Min. measuring range	
(between empty and full adjustment)	> 20 mm (recommended > 50 mm)
Ultrasonic frequency (at 20°C)	
- VEGASON 54	30 kHz
- VEGASON 55	18 kHz
- VEGASON 56	10 kHz
Measuring intervals	
- VEGASON 54	1.0 s
- VEGASON 55	1.5 s
- VEGASON 56	2.0 s
Beam angle at -3 dB emitted power	
- VEGASON 54	4°
- VEGASON 55	5°
- VEGASON 56	6°
Influence of the process temperature	1.8 %/10 K, however is compensated by an integral, dynamic temperature detection system in the transducer
Influence of the process pressure	negligible within the approved sensor pressure range

Ambient conditions

Ambient temperature (housing)	-20°C … +60°C
Process temperature (transducer)	
- VEGASON 54, 55	-40°C … +80°C (StEx: -20°C … +75°C)
- VEGASON 56	-40°C … +150°C
- storage and transport temperature	-40°C … +80°C
Vessel pressure max. (gauge pressure)	
- VEGASON 54	
version A	1.5 bar (flange version)
version B … C	0.5 bar
version D	3 bar
- VEGASON 55	
version A	1.5 bar (flange version)
version B … C	0.5 bar
version D	3 bar
- VEGASON 56	
version A	3 bar (flange version)
version B … C	0.5 bar
version D	3 bar
Protection	
- sensor	IP 67
- transducer, process	IP 68
Protection class	
- two-wire sensor	II
- four-wire sensor	I
Overvoltage category	III
Self-heating	
at 40°C ambient temperature	
- sensor	45°C
- transducer, process	55°C

Ex technical data

Classification	ia intrinsically safe (in conjunction with a safety barrier or separator)
Temperature class (permissible ambient temperature around the transducer when used in Ex areas)	
- T6	42°C
- T5	58°C
- T4	60°C
- T3	60°C
Ex approved in category and zone	
- VEGASON 56	
ATEX	Zone 1 (II 2G)
IEC, CENELEC, PTB	Zone 1
- VEGASON	
ATEX	Zone 21/22 (II 2D/3D)
IEC, CENELEC, PTB	Zone 10/11

Process fittings

VEGASON 54	G 1 A, 1-11.5 NPT, DN 50, DN 80, DN 200
VEGASON 55	G 1 A, 1-11.5 NPT, DN 50, DN 80, DN 250
VEGASON 56	G 1 A, 1-11.5 NPT, DN 50, DN 80, DN 200

Note:
Generally an adapter flange is necessary for G 1 A, 1-11.5 NPT, DN 50, and DN 80.

Connection cables

Two-wire sensors	supply and signal in two separate cables
Electrical connection	spring-loaded terminals, wire cross-section generally 2.5 mm^2
- option	screw connection
Ground connection	max. 4 mm^2
Transducer cable	
- VEGASON 54, 55	5 … 300 m (cable diameter 7.2 … 7.6 mm)
- VEGASON 56	5 … 300 m (cable diameter 9.5 … 9.9 mm)
Cable entry for signal and supply cable with spring-loaded terminals	
- plastic housing (PBT)	2 x M20 x 1.5 (cable diameter 5 … 9 mm) or 2 x $^1/_2$" NPT (cable diameter 3.1 … 8.7 mm or 0.12 … 0.34 inch)
- Aluminium housing	2 x $^1/_2$" NPT (cable diameter 3.1 … 8.7 mm or 0.12 … 0.34 inch)

[1] Similar to DIN 16 086, references conditions acc. to IEC 770;
Temperature 15°C … 35°C; moisture 45 % … 75 %; air pressure 860 mbar … 1060 mbar

Materials

Housing	PBT (Valox) or aluminium
Process fitting	
- flange version	Alu or PP
- swivelling holder and thread	galvanised steel
Transducer	
- VEGASON 54	PA (1.4301 at StEx)
- VEGASON 55, 56	UP
Transducer diaphragm	
- VEGASON 54	1.4571
- VEGASON 55	Alu/PE foam
- VEGASON 56	Alu/PTFE nonadhesive coating
Transducer cable (cable cover)	
- VEGASON 54, 55	PUR (1.1082)
- VEGASON 56	silicone (1.1083)

Weight

VEGASON 54	
- version A	5.6 ... 10.7 kg
- version B	6.9 ... 9.7 kg
- version C	7.5 ... 10.5 kg
- version D	4.7 ... 6.9 kg
VEGASON 55	
- version A	8.0 ... 13.3 kg
- version B	8.7 ... 10.3 kg
- version C	9.2 ... 11.1 kg
- version D	6.5 ... 7.5 kg
VEGASON 54	
- version A	7.3 ... 11.3 kg
- version B	8.7 ... 10.3 kg
- version C	9.3 ... 11.1 kg
- version D	6.5 ... 7.5 kg

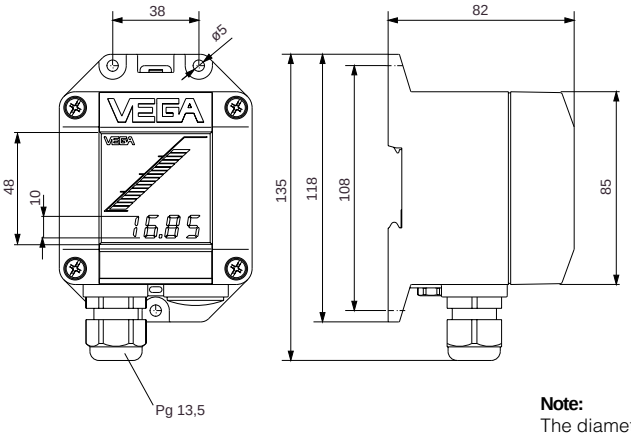
CE conformity CE

VEGASON series 50 ultrasonic sensors meet the protective regulations of EMC (89/336/EWG) and NSR (73/23/EWG). Conformity has been judged acc. to the following standards:

EMC	Emission	EN 50 081 - 1: 1993
	Susceptibility	EN 50 082 - 2: 1995
NSR		EN 61 010 - 1: 1993
		EN 61 326 - 1: 1997/A1:1998

3.2 Dimensions

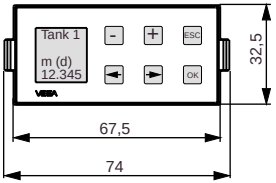
External indicating instrument VEGADIS 50



Mounting on carrier rail 35 x 7.5 acc. to EN 50 022 or flat screwed

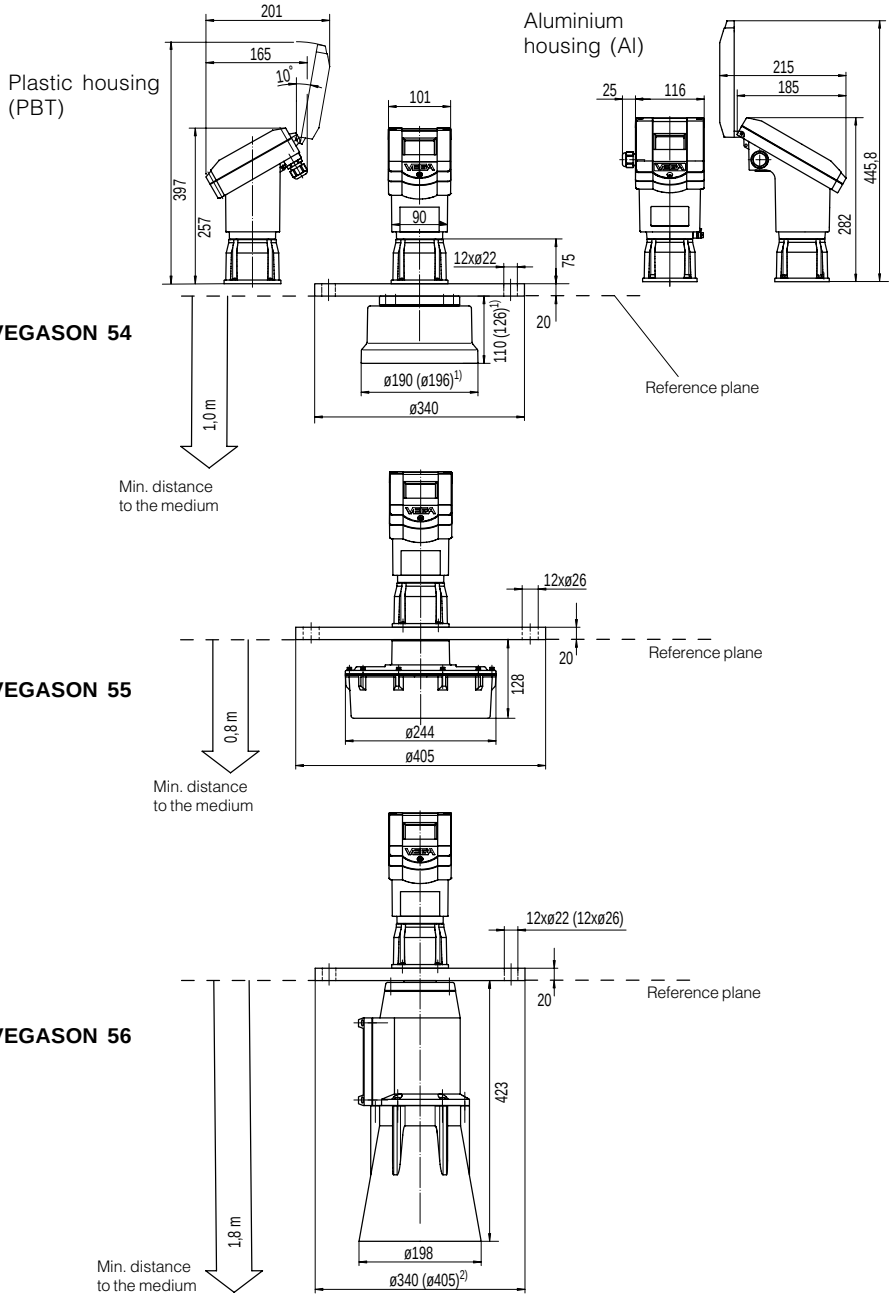
Note:
The diameter of the connection cable must be 5 … 9 mm.
Otherwise the seal effect of the cable entry will not be ensured.

Adjustment module MINICOM

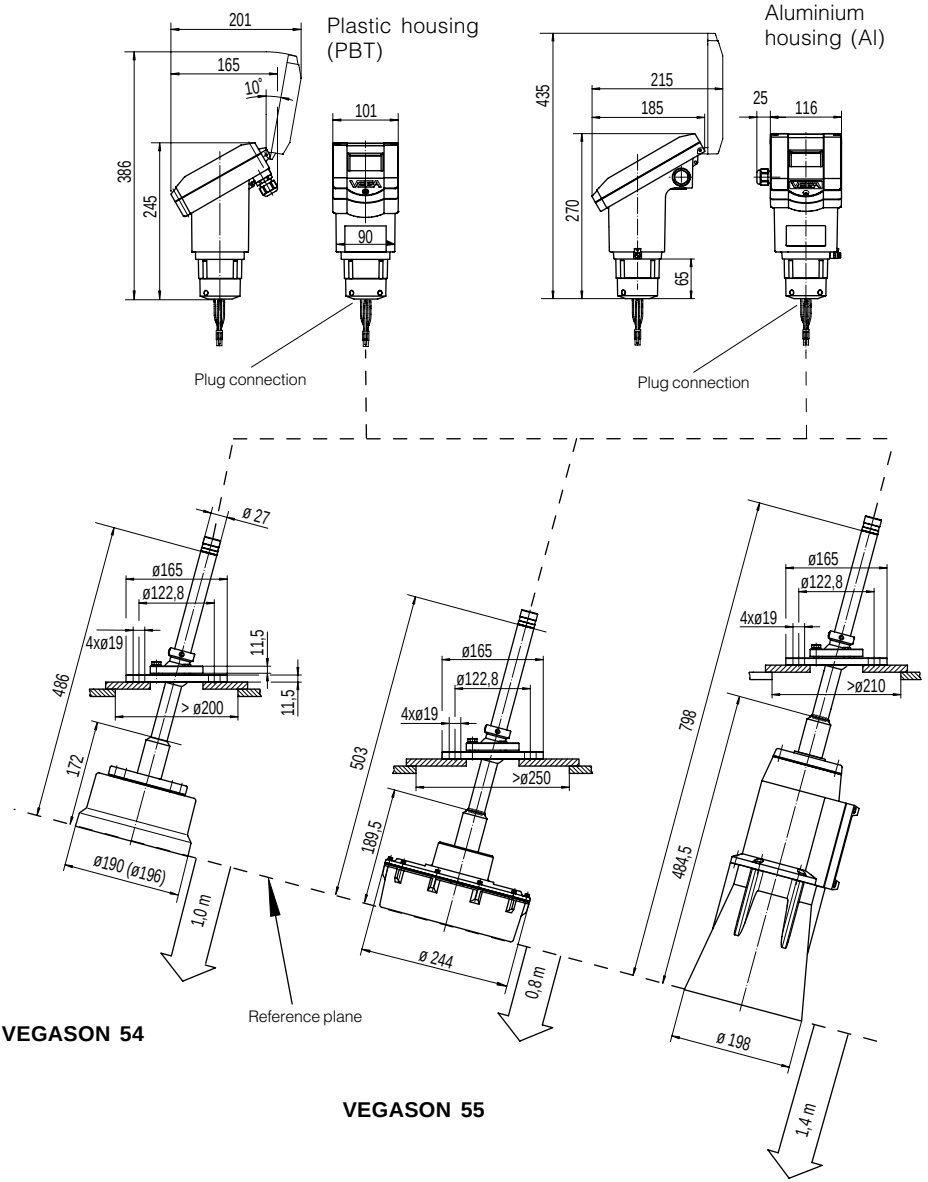


Adjustment module for insertion into VEGASON series 50 sensor or into the external indicating instrument VEGADIS 50

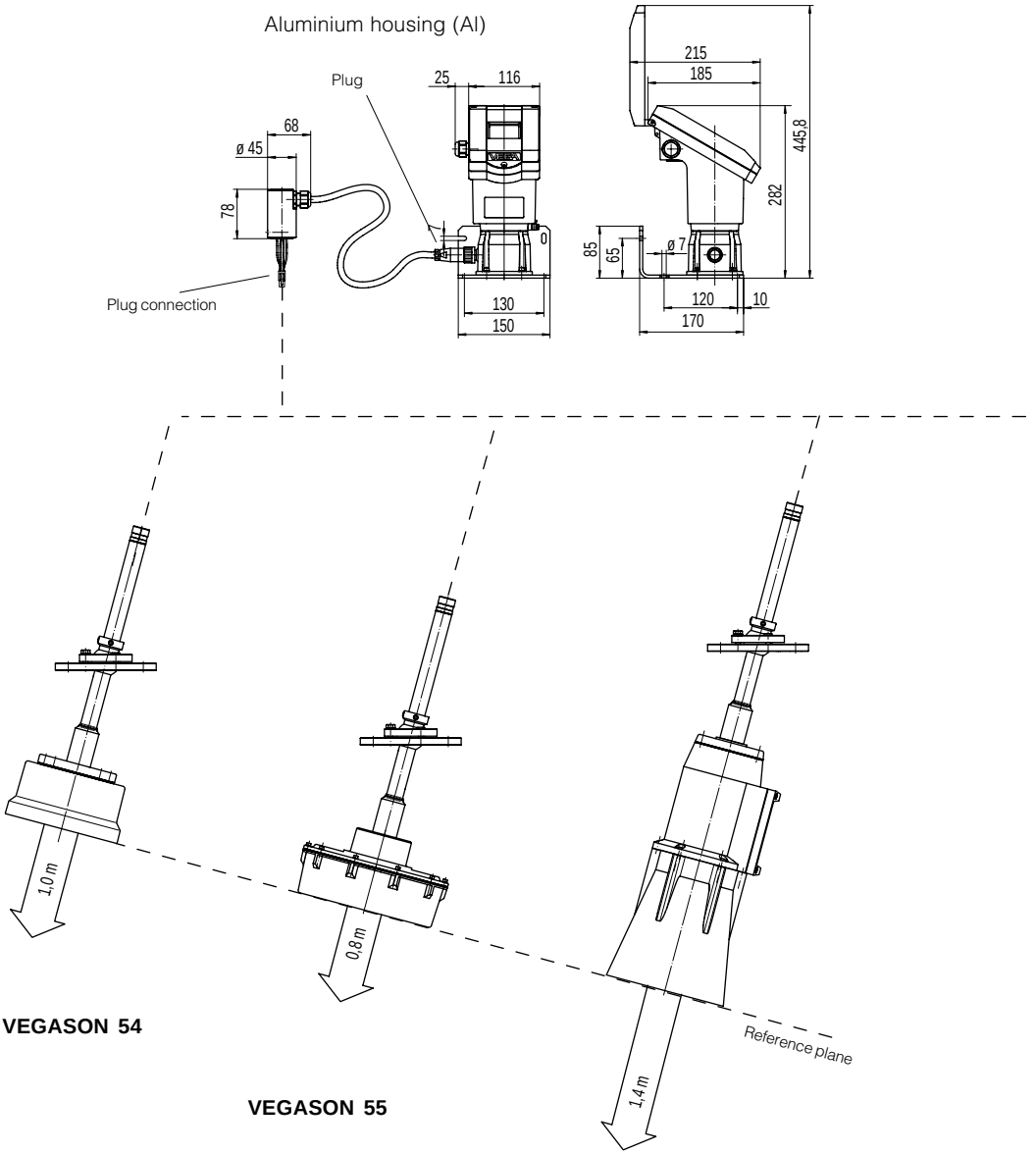
VEGASON 54 ... 56 in version A



VEGASON 54 ... 56 in version B



VEGASON 54 ... 56 in version C

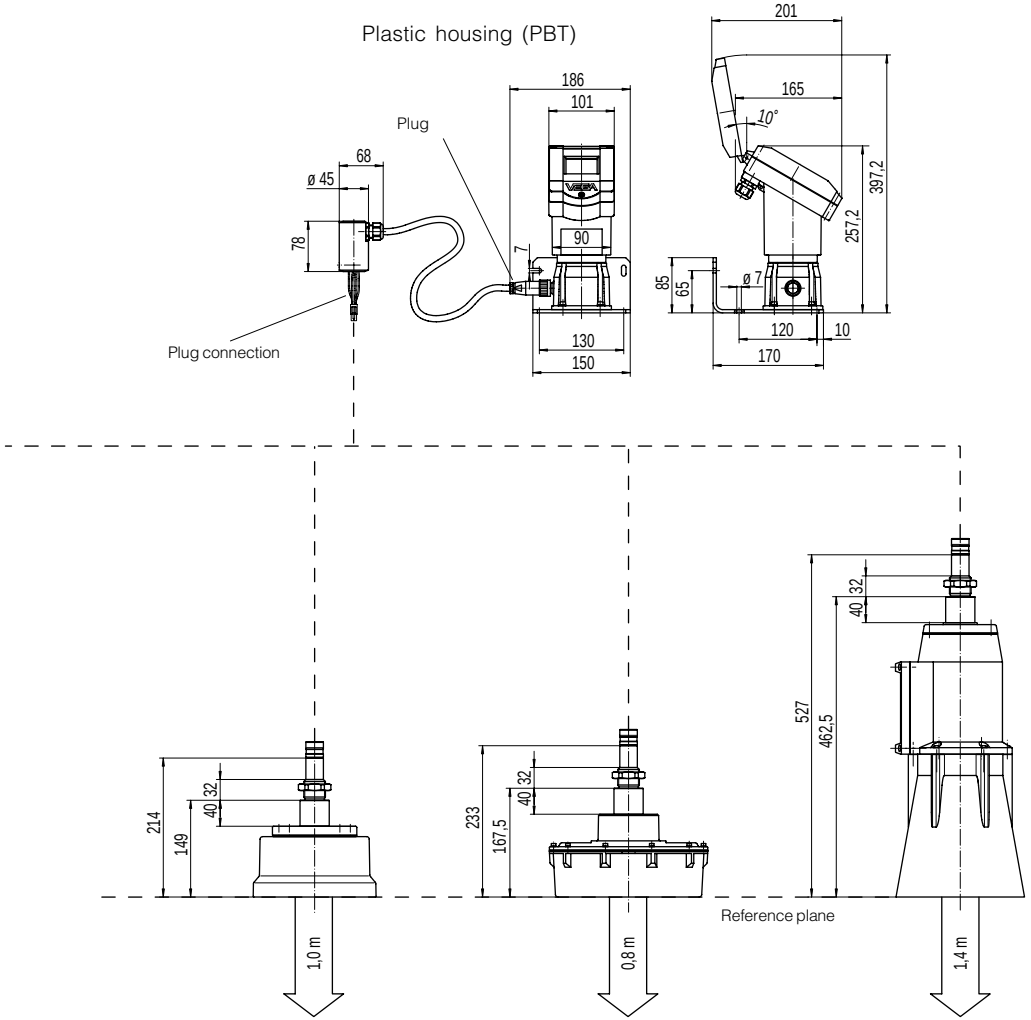


VEGASON 54

VEGASON 55

VEGASON 56

VEGASON 54 ... 56 in version D



VEGASON 54 **VEGASON 55** **VEGASON 56**

4 Mounting and installation

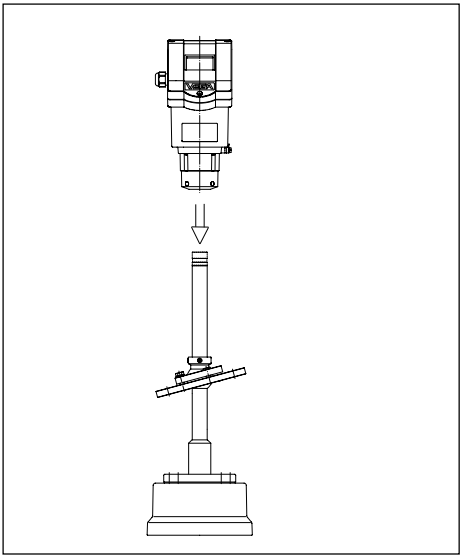
4.1 Mounting

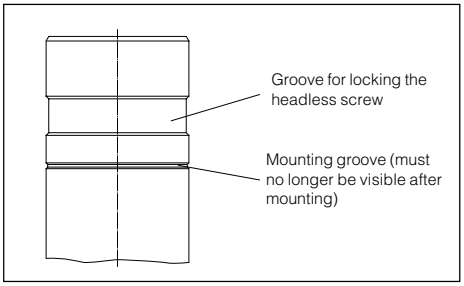
Version A

Sensors in version A (flange version) are supplied completely mounted and ready for operation. Immediately after mounting on the vessel and electrical connection, they are ready for operation.

Version B

The sensors in version B are supplied in two parts (transducer and sensor electronics). First of all, mount the transducer on the vessel or above the medium. There is a four-pole jack at the end of the transducer tube. The respective counterpart to the jack protrudes out of the lower side of the sensor electronics housing. Insert the plug of the sensor electronics (only possible in one position), into the jack of the transducer tube. Continue pushing the electronics housing onto the transducer tube, on which there is a wide and a narrow groove.

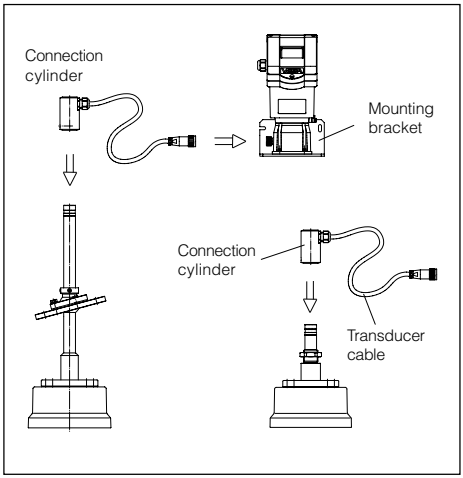




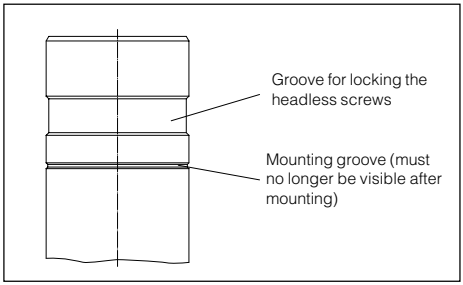
The wide groove is used for locking the headless screws. The narrow groove is a marking for mounting. Move the electronics housing farther down over the transducer tube until the mounting groove is no longer visible. Fasten the housing with the headless screws to the transducer tube. Use a 5 mm hexagon screwdriver (or Allen wrench).

Version C and D

The sensors in version C and D are supplied in three parts (transducer, sensor electronics and transducer cable). First mount the transducer (see version B). There is a four-pole jack at the transducer tube end. A respective counterpart to the jack is provided in the connection cylinder of the transducer cable. Insert the connection cylinder plug into the jack of the transducer tube.



On the end of the transducer tube you find a wide and a narrow groove. The wide groove is used for locking the cylinder with the headless screws. The narrow groove is the mounting mark.



Then push the connection cylinder onto the transducer tube (with a slight swivelling motion) until the mounting mark is no longer visible.

When the mounting mark is covered by the cylinder, fasten the cylinder with the two headless screws. Use a 5 mm hexagon screwdriver (or Allen wrench).

Now mount the sensor electronics in the requested location. The sensor electronics is fastened to a mounting bracket, so that it can be mounted to a plane surface or to the wall. Make sure that the sensor housing is mounted in such a way that there is enough space above the housing to open the cover.

Now insert the plug at the other end of the transducer cable into the jack on the electronics housing.

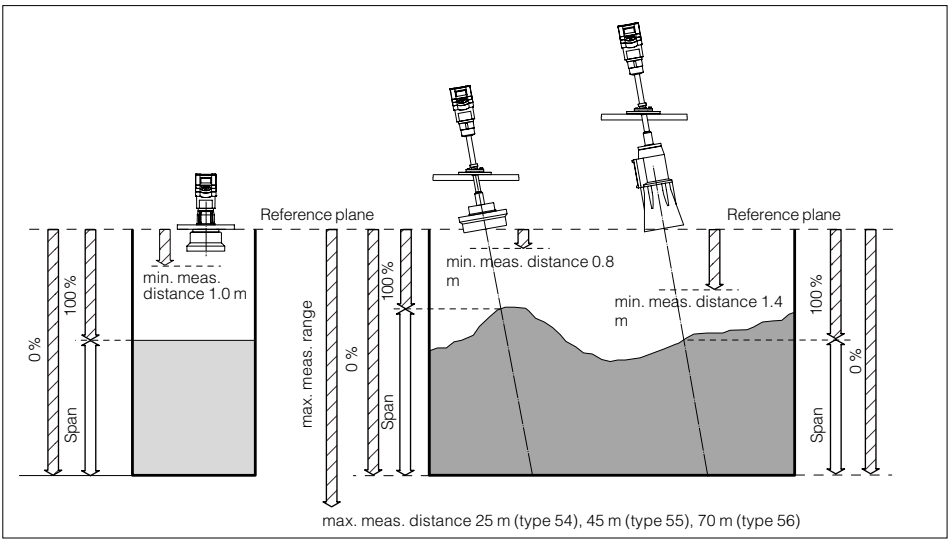
Note:
Avoid bending the transducer cable too sharply when laying it out. This is special cable which could otherwise be damaged.

In addition, make sure that the cable is not damaged during operation. A signal with a voltage of approx. 1 kV is transmitted (which could be a danger in Ex areas if the cable is damaged) is transmitted via the screened cable cones.

4.2 General installation instructions

Measuring range

Beside other criteria, you select your instrument according to the required measuring range. The reference planes for the min. and max. distance to the product or solid is the transducer end or for instruments in flange version, the instrument flange (version A). Please note the information on the reference planes in chapter "3.2 Dimensions". The max. filling depends on the required min. distance and the mounting location.



Min. distance, max. measuring range, span and reference plane

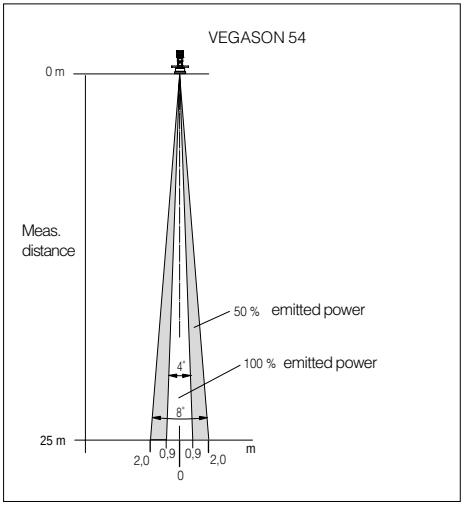
Beam angle and false echoes

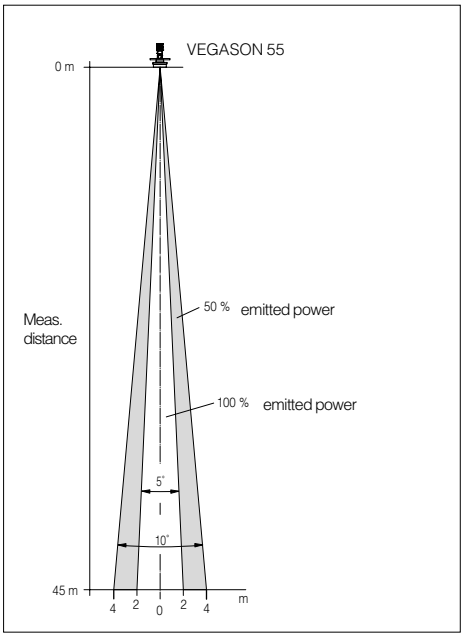
The ultrasonic impulses are focused by the transducer. The impulses leave the transducer in conical form similar to the beam pattern of a spotlight. The beam angle is 4° (VEGASON 54), 5° (VEGASON 55) and 6° (VEGASON 56) at -3 dB emitted power. Any object, e.g. tubes or struts inside this emission cone will cause a false echo. Especially within the first few meters of the emission cone, pipes, struts, or other installations can interfere with the measurement. At a distance of 6 m, the false echo of a strut has an amplitude nine times greater than at a distance of 18 m.

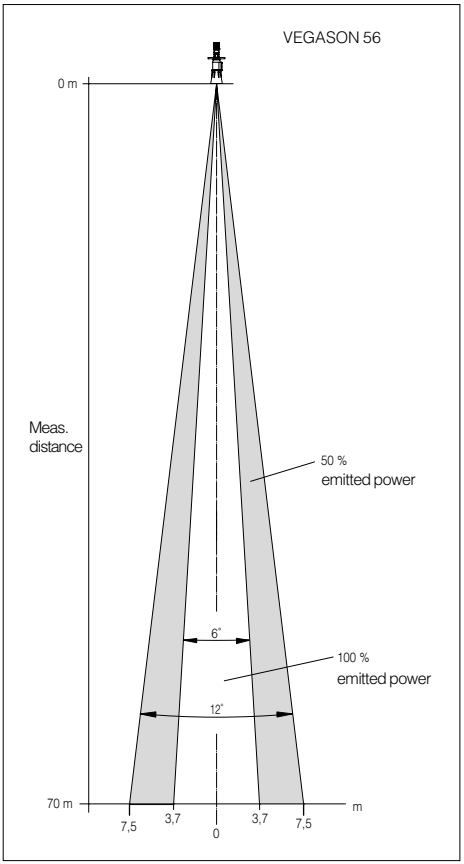
At greater distances, the energy of the ultrasonic impulses distributes over a large area, thus causing weaker echoes from obstructing surfaces. The interfering signals are therefore less critical than those at close range.

If possible, orient the sensor axis perpendicularly to the product surface and avoid vessel installations (e.g. pipes and struts) within the 100 % area of the emission cone.

The following illustration of the ultrasonic beams is simplified and represents only the main beam, however there are a number of additional beams.





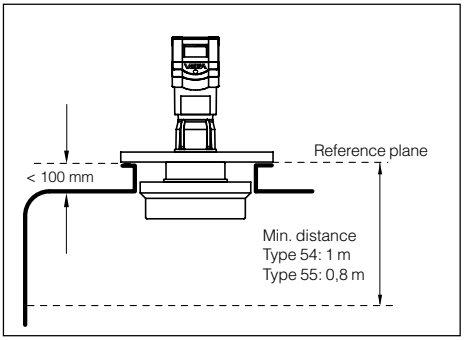


Therefore in practical application, the transducer has to be oriented so that lowest possible false echo signal strength is achieved. Just focussing a large useful echo is therefore not always sufficient. In most cases, a low false echo level enables the sensor to reliably pick up the useful echo. With the adjustment software VVO on the PC you can have a look at the echo image, see chapter "6.2 Adjustment with the PC“ under the subheading "Sensor optimisation/Echo curve“.

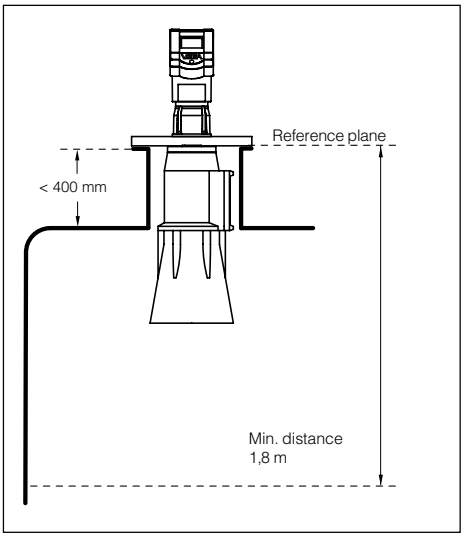
4.3 Measurement of liquids

Flat vessel top

On flat vessels, the mounting is usually done on a very short DIN socket piece. Reference plane is the lower edge of the flange. The transducer should protrude out of the flange tube.

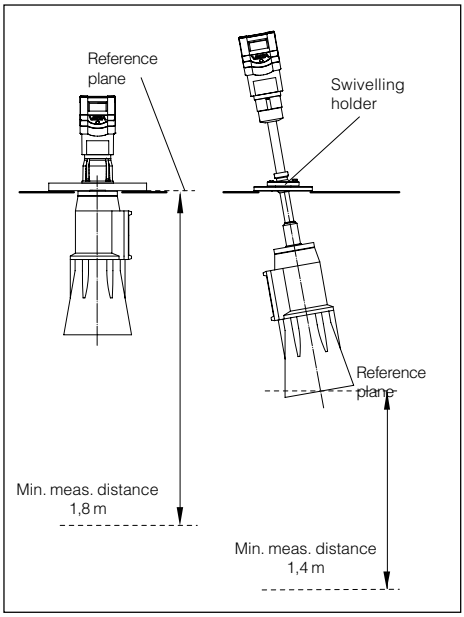


VEGASON 55 in flange version on short DIN socket piece



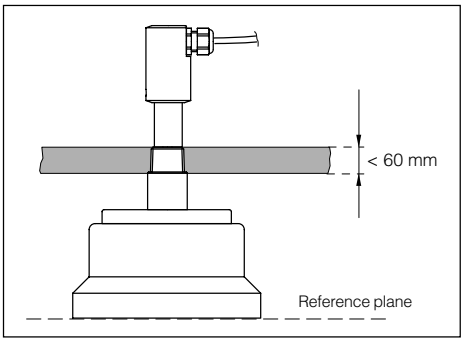
VEGASON 56 in flange version on short DIN socket piece

A mounting location directly on the vessel top is ideal. A round opening in the vessel top is sufficient to fasten the sensor with the flange, or version B and C with swivelling holder.



Flange version and swivelling holder on flat vessel top

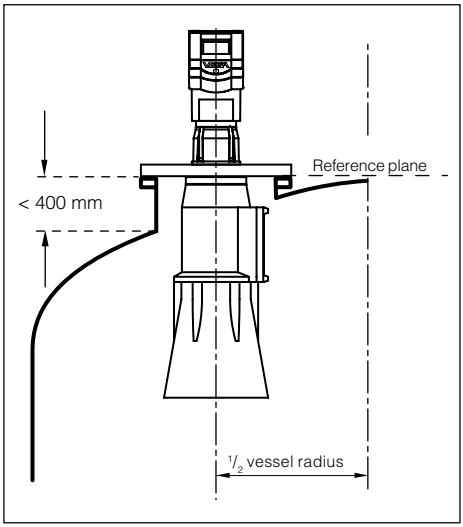
It is also possible to mount the sensors in version C in a 1“ thread.



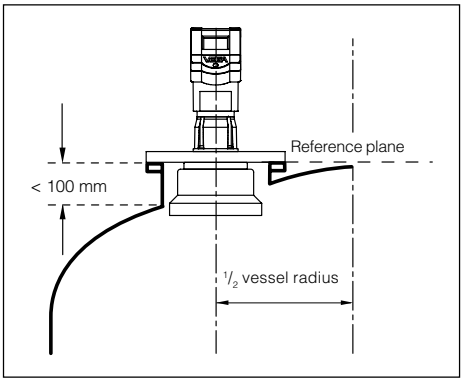
Mounting of the transducer in 1“ thread

Dished tank ceiling

On dished tank ceilings, please do not mount the instrument in the centre, but approx. $^1/_2$ vessel radius from the centre. Dished tank ceilings can act as paraboloidal reflectors. If the transducer is placed at the focal point of the parabolic ceiling, the transducer receives amplified false echoes. The transducer should be mounted outside the focal point. Amplified echoes caused by parabolic surfaces are thereby avoided.



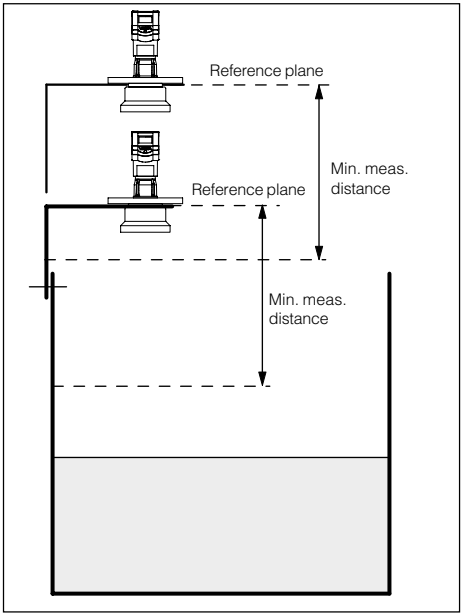
VEGASON 56 on dished tank ceiling



VEGASON 54 on dished vessel ceiling; the statements are also valid for VEGASON 55

Open vessels

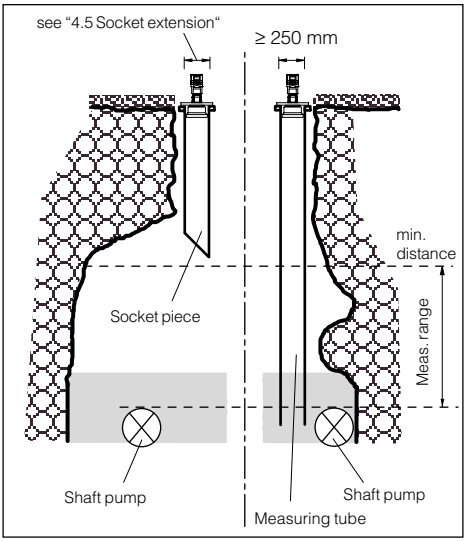
On open vessels, use of instrumentson an extended mounting bracket is recommended. Mount the low-weight sensor onto such a bracket and ensure a sufficient distance to the vessel wall.



Open vessels

Pump shaft

Narrow shafts and shaft openings (vessel openings) with very rough walls and shoulders make an ultrasonic measurement extremely difficult due to strong false echoes. This problems can be overcome by using an extended socket piece or a complete measuring tube (see chapter "4.5 Socket extension").



Example of a socket extension or measuring tube in a shaft

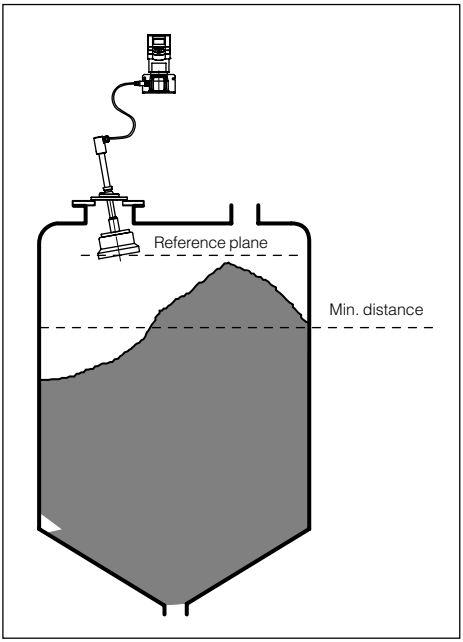
Shaft

Very good measuring results can be attained with a measuring tube in continuous narrow shafts, see figure. The applied measuring tube must have smooth walls inside (e.g. PE sewage pipe) and a diameter ≥ 100 mm. This arrangement works well as long as the inside of the measuring tube collects no dirt or buildup (cleaning necessary). You might want to consider using hydrostatic pressure transmitters or capacitive measuring probes. Either the measuring tube should never be immersed in the medium, or it must always be immersed, so that the measurement is carried out exclusively in the tube.

4.4 Measurement of solids

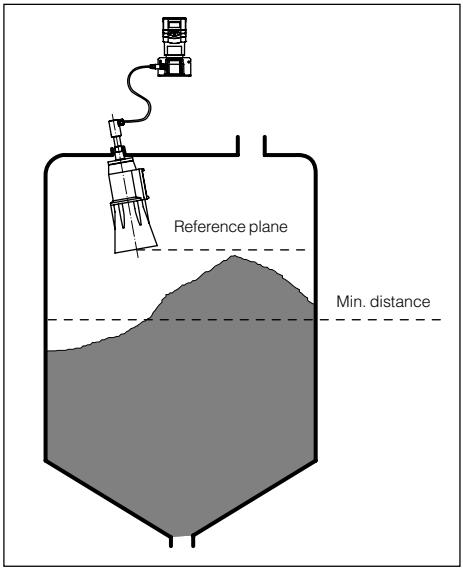
Flange mounting

As with applications for liquids, the instrument can be mounted on a short DIN socket connection on vessels for solids. The transducer axis must only point to the vessel outlet or should be directed perpendicular to the product surface. The socket length can be max. 300 mm.



VEGASON 54C with an adapter flange on a DN 200 vessel flange

Mounting boss

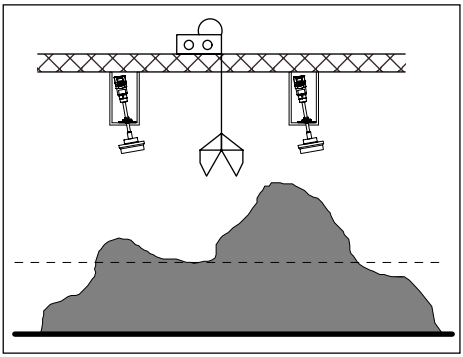


VEGASON 56 in 1" mounting boss

The socket axis should point to the product surface. Much better would be the use of a swivelling holder version (type B, C).

Material heaps

Large material heaps are detected with several instruments, which can be mounted on e.g. traverse cranes. For this type of application, it is best to orient the sensor toward the solid surface.



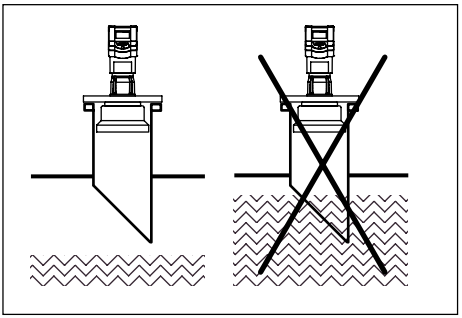
Transducer on traverse crane above a material heaps

4.5 Socket extensions

The ultrasonic sensors require a min. distance to the product or solid. Take the min. distance into account in your planning. In some situations, it is possible to reach the required min. distance, and hence the desired filling height, with a socket extension. However, the socket extension increases the noise level of the ultrasonic signal at the extension outlet and can interfere with the measurement. Only use a socket extension if all other possibilities have to be excluded. Carry out the extension as shown in the following illustration.

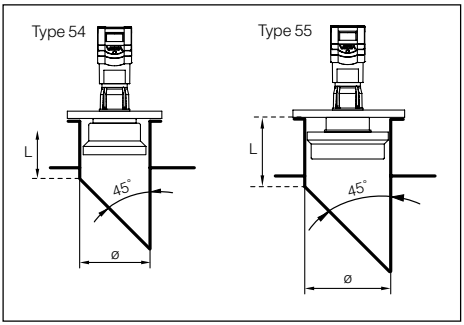
Socket extensions in liquids

Chamfer and deburr the socket carefully and make sure it has a smooth inner surface. The socket should not protrude into the measured product, in case buildup can form on the socket through pollution or product residues.



Socket piece should not be immersed into adhesive products (figure: VEGASON 53)

The socket diameter should be as large and the socket length as small as possible. Make sure that the socket outlet is burr-free to minimise false echoes.

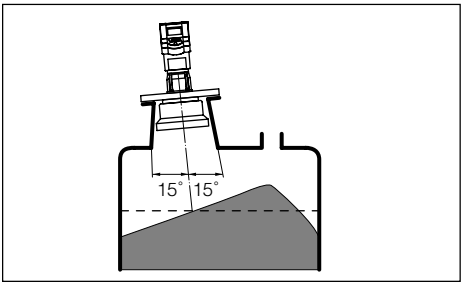


Socket extensions that do not protrude into the measured product

Max. socket length in relation to socket diameter

ø in mm	L in mm Type 54	Type 55	Type 56
200	400	––	––
250	500	500	500
300	––	––	600

Socket extensions for solids
For solids, use a conical socket extension with a taper of at least 15° ... 20°.



Socket extension in solids

Measurement in a tube

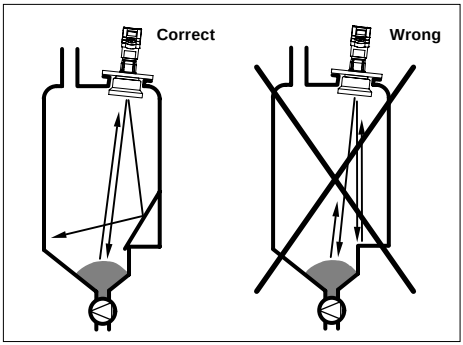
For nonadhesive measured products, a socket extension in form of a measuring tube can be permanently submerged in the product. The ultrasonic measurement is then made exclusively in the measuring tube and works very well without interference from other vessel installations (see "Pump shaft").

4.6 False echoes

The mounting location of the ultrasonic sensor must be selected such that no installations or inflowing material are in the path of the ultrasonic impulses. The following examples and instructions show the most frequent measuring problems and how to avoid them.

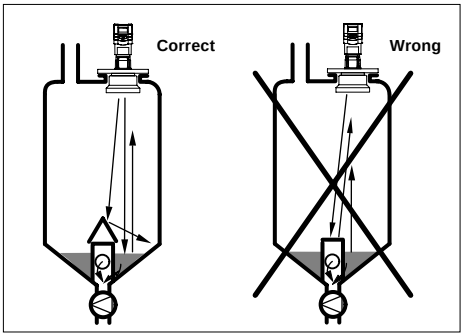
Vessel protrusions

Vessel forms with flat protrusions can, due to their strong false echoes, adversely effect the measurement. Shields above these flat protrusions scatter the false echoes and guarantee a reliable measurement.



Vessel protrusions (slope)

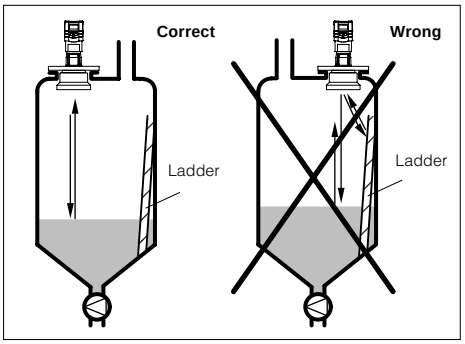
Intake pipes, e.g. for the mixing of materials - with a flat surface directed towards the sensor - should be covered with a sloping shield. This shield will scatter false echoes.



Vessel protrusions (intake pipe)

Vessel installations

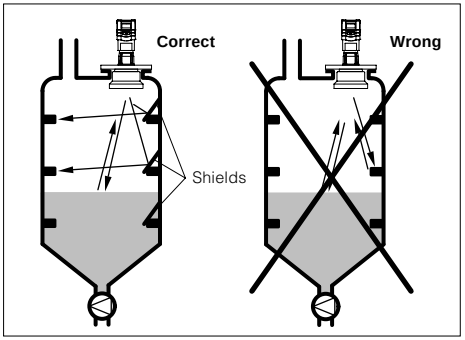
Vessel installations such as, for example, a ladder, often cause false echoes. Make sure when planning your measurement loop that the ultrasonic signals have free access to the measured product.



Vessel installations

Struts

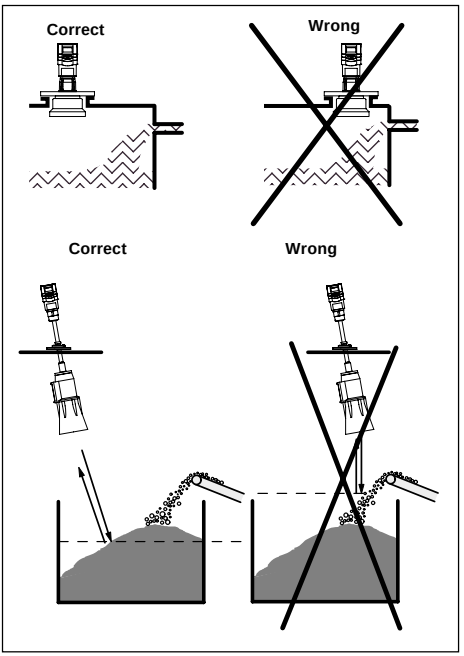
Struts, like other vessel installations, can cause strong false echoes that are superimposed over the useful echo signals. Small shields effectively hinder a direct false echo reflection. These false echoes are scattered and diffused in the area and are then filtered out as "echo noise“ by the measuring electronics.



Struts

Inflowing material

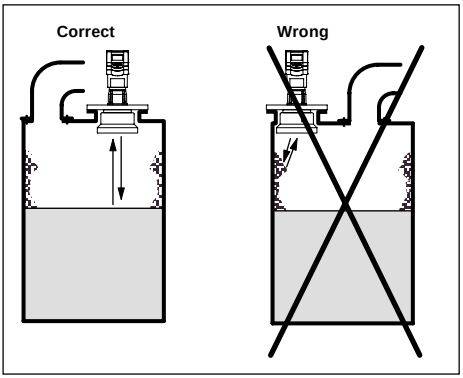
Do not mount the instrument in or above the filling stream. Ensure that you detect the product surface and not the inflowing material.



Inflowing material

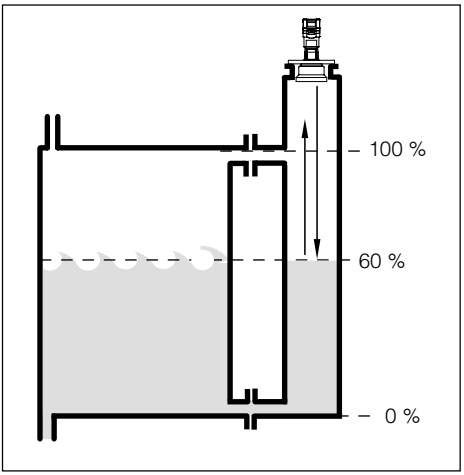
Buildup

If the sensor is mounted too close to the vessel wall, buildup and adhesions of the measured product to the vessel wall can cause false echoes. Position the sensor at a sufficient distance from the vessel wall. Please also note chapter "4.2 General installation instructions“.



Buildup

Strong product movements
Heavy turbulences in the vessel, e.g. by strong stirrers or strong chemical reactions, seriously interfere with the measurement. A surge or bypass tube of sufficient size (DN 200, DN 250) always allows, provided the product causes no buildup in the tube, a reliable measurement even with strong turbulences in the vessel.

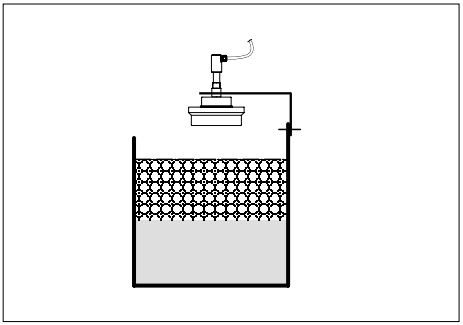


Heavy turbulences

4.7 Incorrect mounting

Foam generation

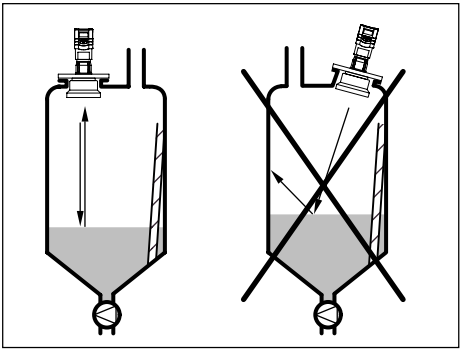
Thick foam on the product can cause incorrect measurements. Take measures to avoid foam, carry out the measurement in a bypass tube, or use a different measuring technology, e.g. capacitive measuring probes or hydrostatic pressure transmitters.



Foam generation

Wrong orientation to the product

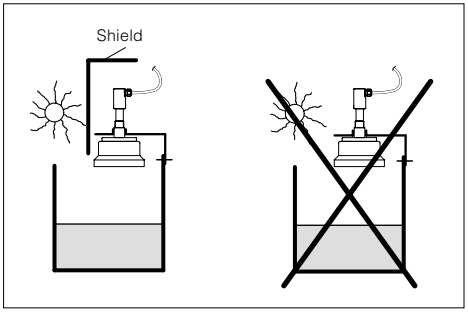
Weak measuring signals are the result if the sensor is not directly pointed at the product surface. Orient the sensor axis perpendicularly to the product surface to achieve optimum measuring results.



Orient the sensor perpendicularly to the product surface

Strong heat fluctuations

Strong heat fluctuations, e.g. due to the sun, cause measuring errors. Please provide a sun shield.

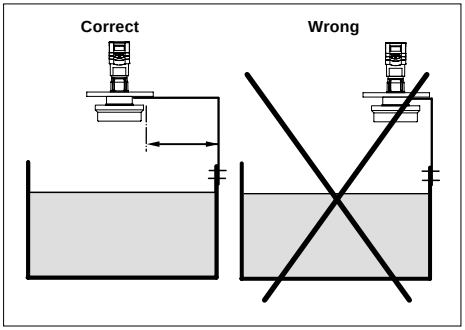


Strong heat fluctuations

Min. distance to the medium

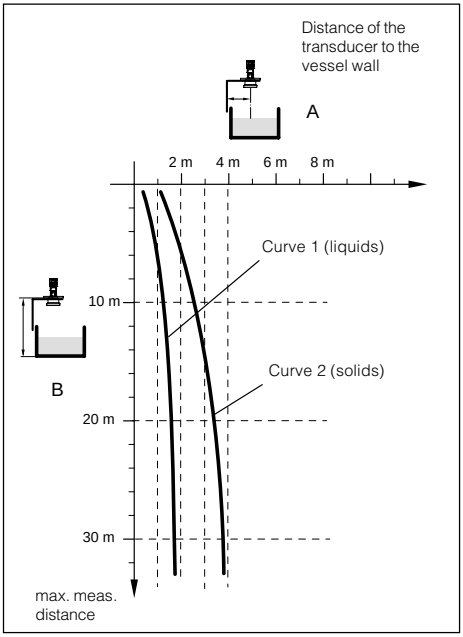
If the min. distance to the medium is not maintained, the instruments show wrong measured values. Mount the instrument at the required min. distance.

Sensor too close to the vessel wall



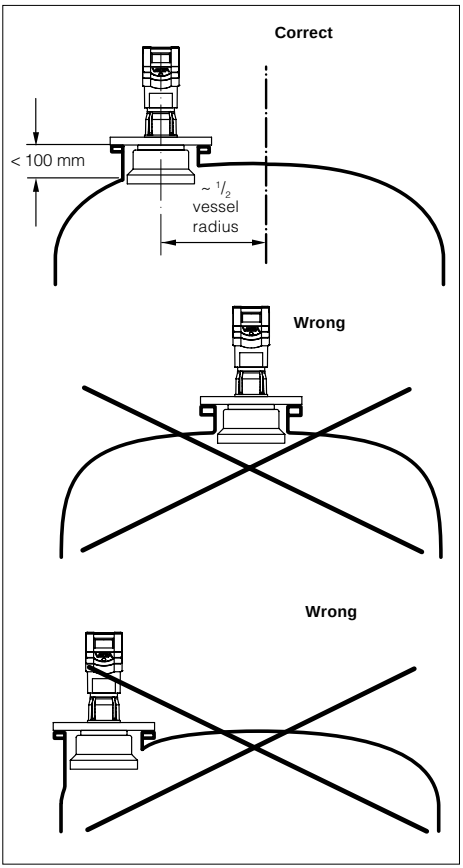
Sensor too close to the vessel wall

If the sensor is mounted too close to the vessel wall (dimension A in diagram), strong false echoes can be caused. Buildup, rivets, screws or weld joints on the vessel wall superimpose their echoes to the product or useful echo. Please ensure the sufficient distance of the sensor to the vessel wall, depending on the maximum measuring distance (dimension B in diagram). In case of good reflection conditions (liquids, no vessel installations), we recommend determining the sensor distance according to **Diagram curve 1**. At a max. meas. distance of e.g. 10 m, the distance of the transducer (according to curve 1) should be approx. 1.5 m. In case of solids with bad reflection properties, determine the distance to the vessel wall according to **Diagram curve 2**. Under very bad measuring conditions (rough vessel walls, struts), it might be necessary, to increase the distance to the vessel wall, or to filter out the false echoes in addition by storing them in memory, thereby adapting the sensor more precisely to the environment.



Parabolic effects of rounded or arched vessel tops

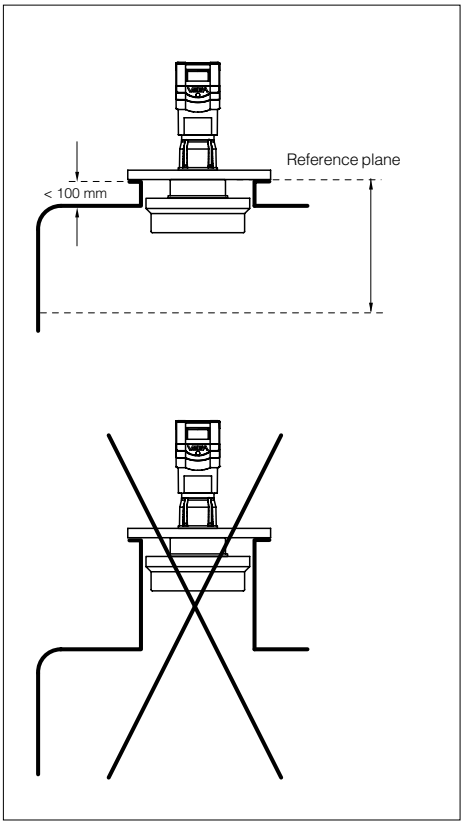
Round or parabolic tank tops act like a parabolic mirror for the signals. If the sensor is placed at the focal point of such a parabolic tank top, the sensor receives amplified false echoes. The optimum location is generally in the area of half the vessel radius from the centre.



Mounting on a vessel with parabolic tank top

Socket piece too long

If the sensor is mounted in a socket extension that is too long, strong false echoes are caused, and measurement is hindered. Make sure that the transducer protrudes at least 30 mm out of the socket piece.



Correct and wrong length of socket piece

5 Electrical connection

5.1 Connection and connection cable

Safety information

As a rule, do the work in the complete absence of voltage. Always switch off the power supply before you carry out connecting work on the ultrasonic sensors. Protect yourself and the instruments, especially when using sensors which do not operate with low voltage.

Qualified personnel
Instruments which are not operated with protective low voltage or DC voltage must only be connected by qualified personnel.

Connection

A standard two or four-wire cable (sensors with separate supply) with max. 2.5 mm^2 can be used for connection. Please note that the connection cables are specified for the expected operating temperatures in your systems. The cable must have an outer diameter of 5 … 9 mm or 3.6 … 8.6 mm, to ensure the seal effect of the cable entry.

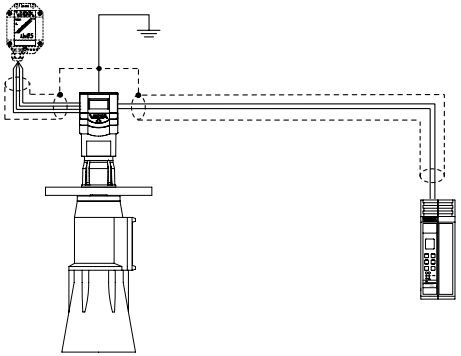
Transducer cable
When wiring the transducer cable, avoid strong bending of the cable. This is a special cable which will otherwise be damaged.

Make sure that the cable will not be damaged during operation. The screened transducer cables transmit a signal with a voltage of approx. 1 kV. In Ex areas, a cable damage can be dangerous.

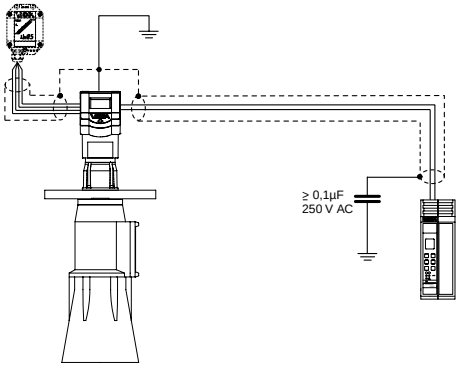
Earth conductor terminal

The electronics housing of the sensors has a protective insulation. The earth conductor terminal and the earth terminal in the electronics housing are galvanically connected with the metallic transducer diaphragm.
On sensors in version B, the earth conductor terminal is galvanically connected to the transducer diaphragm via the transducer tube when the sensor is completely mounted. On version C and D, the connection is made via the cable screen of the transducer cable and the transducer tube.

Earthing on one sensor side



Earthing on both ends (on the signal conditioning instrument via potential separation capacitor)



Shielding of the sensor cables

The "Electromagnetic pollution“ from electronic actuators, power lines and transmitting stations is often so considerable that the sensor cable should be shielded.

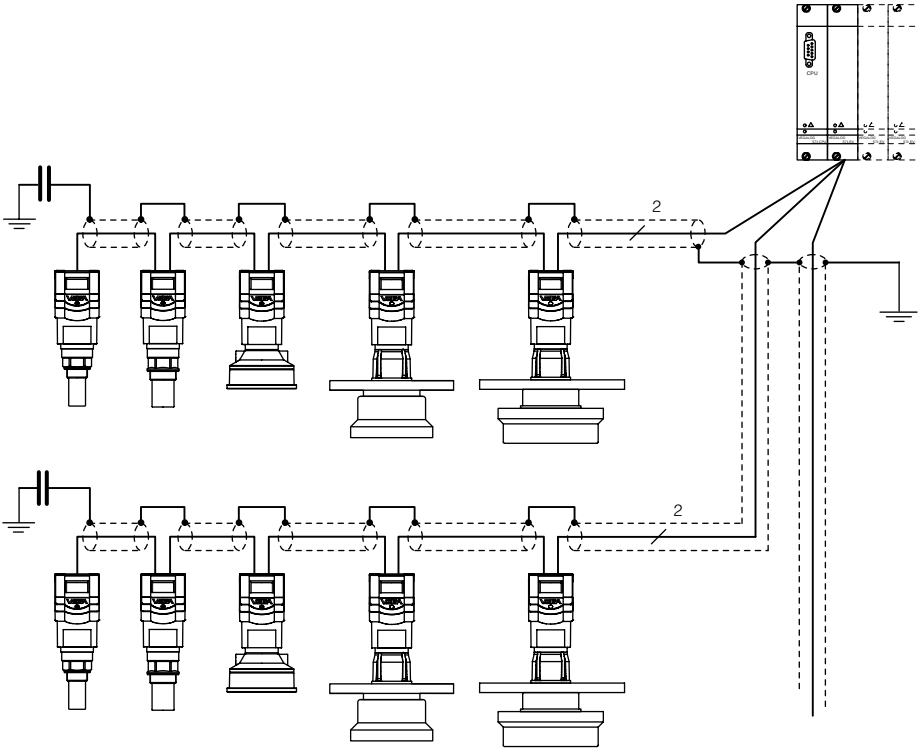
We recommend a screening on both ends. Screening is a good preventative measure against future sources of interference. However, you must make sure that no ground potential currents flow through the sensor cable shields. Ground potential currents can be avoided by potential equalisation cables. When grounding at both ends, it is possible to connect the cable shield on one side (e.g. in the switching cabinet) via a capacitor (e.g. 0.1 µF; 250 V) to the ground potential. Use a low-resistance ground connection (foundation, plate or mains earth).

Note Ex protection!
In Ex applications, grounding on both ends is not allowed due to potential losses. If an instrument is used in hazardous areas, the respective regulations, conformity certificates and type approvals for systems in Ex areas must be noted (e.g. DIN 0165).

Please note the approval documents with the safety data sheet attached to the Ex sensors.

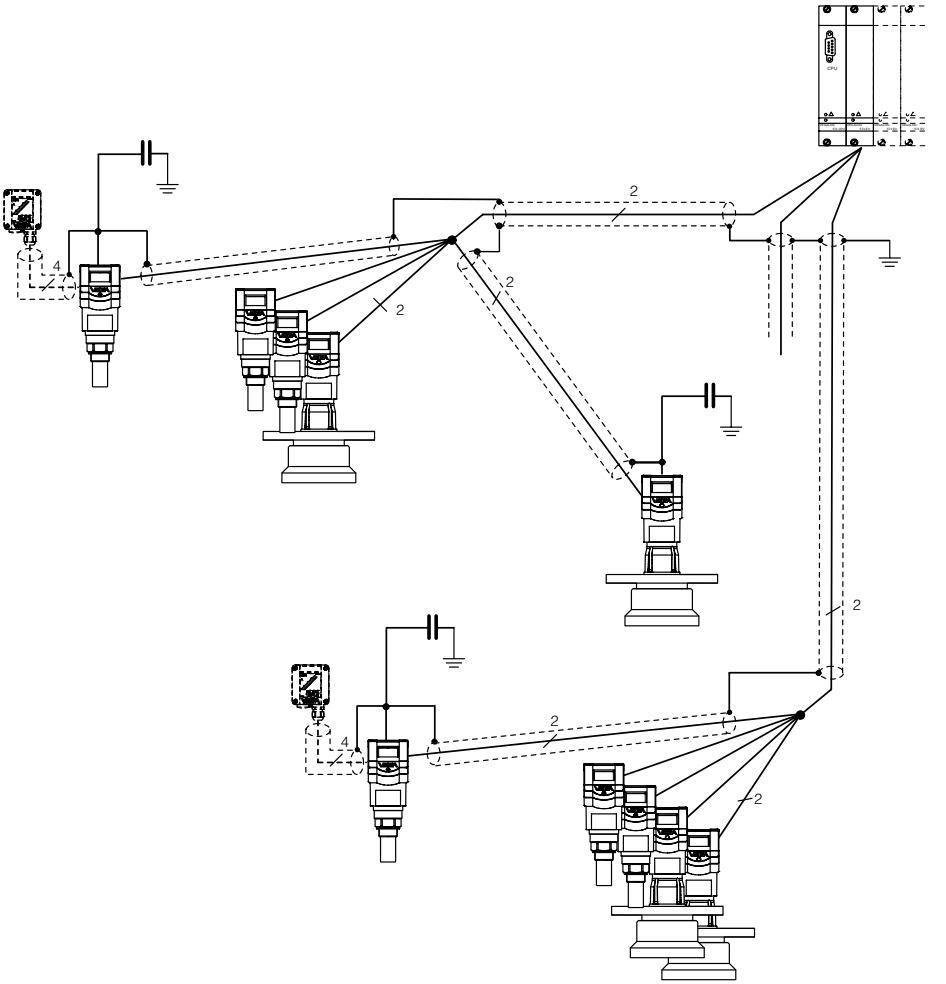
Linear (serial) arrangement

Grounding of the cable screen on both ends, at the end of each sensor line via a ground capacitor.



Radial arrangement

Grounding on at least two ends, on VEGALOG and once on the sensor star, i.e. on the longest sensor line. If the individual sensor lines are longer than approx. 15 m, a grounding of each longer line should be made via a ground capacitor.



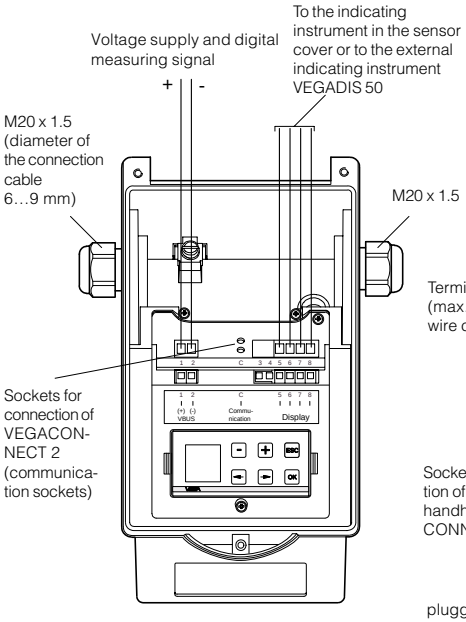
5.2 Connection of the sensor

After mounting the sensor at the measurement location according to the instructions in chapter "4 Mounting and installation", loosen the closing screw on top of the sensor. The sensor lid with the optional indication display can then be opened. Unscrew the sleeve nut and slip it over the connection cable (after removing about 10 cm of insulation). The sleeve nut of the cable entry has a self-locking ratchet that prevents it from opening on its own.

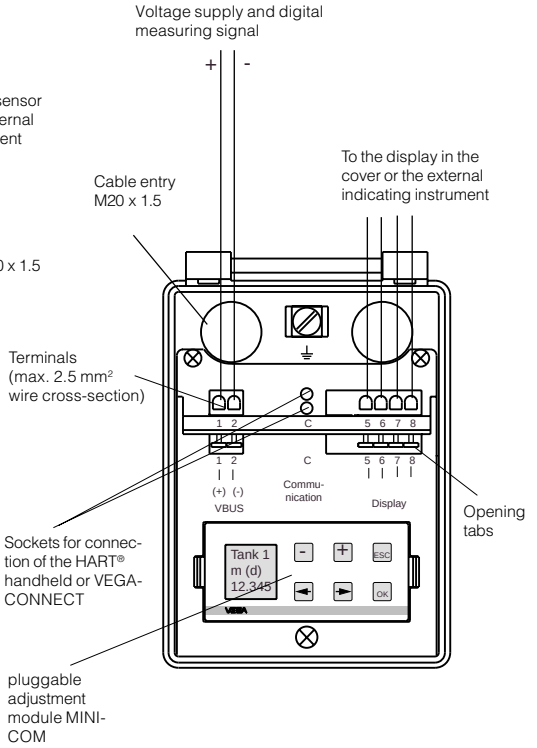
Now insert the cable through the cable entry into the sensor. Screw the sleeve nut back onto the cable entry and clamp the stripped wires of the cable into the proper terminal positions.

The terminals hold the wire without a screw. Press the white opening tabs with a small screwdriver and insert the copper core of the connection cable into the terminal opening. Check the hold of the individual wires in the terminals by lightly pulling on them.

Version with aluminium housing

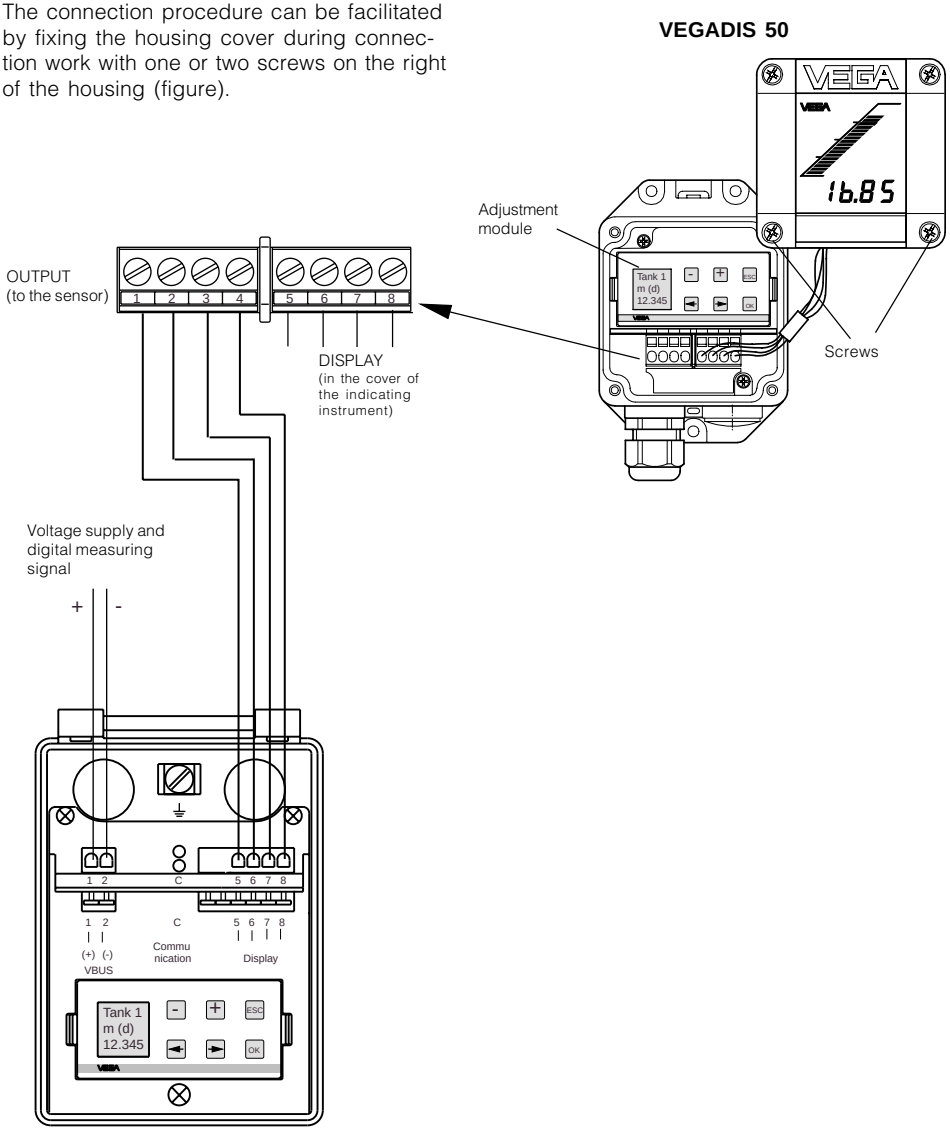


Version with plastic housing



5.3 Connection of the external indicating instrument VEGADIS 50

Loosen the four screws of the housing cover on VEGADIS 50.
The connection procedure can be facilitated by fixing the housing cover during connection work with one or two screws on the right of the housing (figure).



6 Setup

6.1 Adjustment methods

VEGASON 51V ... 56V ultrasonic sensors can be adjusted with
- PC (adjustment program VVO)
- detachable adjustment module MINICOM or
- VEGAMET signal conditioning instrument.

The adjustment must only be carried out with one adjustment device.

With the PC
The PC with the adjustment program VVO (VEGA Visual Operating) can be connected to:
- the sensor
- the signal cable
- the VEGAMET 514V, 515V signal conditioning instrument
- the VEGALOG 571 processing system

With the adjustment program VVO (VEGA Visual Operating System) on the PC you can adjust the ultrasonic sensors very comfortably. The PC communicates via the interface adapter VEGACONNECT 2 with the sensor and the signal conditioning instrument or with the standard RS 232 interface cable to the VEGALOG processing system and all connected sensors. A digital adjustment signal is superimposed on the signal and supply cable. The adjustment can be carried out directly on the sensor or at any desired location along the signal cable or on the processing system VEGAMET or VEGALOG.

In the following chapter "6.2 Adjustment with the PC on VEGAMET", the adjustment is described when connecting the PC via the VEGACONNECT on VEGAMET. When connecting the PC via VEGACONNECT to the sensor signal cable (see "2.4 Configuration of measuring systems"), all sensors connected to the affected signal cable are available for adjustment. However, the configuration and measured data processing functions of VEGAMET are not available.

When inserting VEGACONNECT into the communication socket of an individual sensor, only sensor-relevant adjustment options such as e.g. sensor optimisation on the affected sensor are adjustable. Other sensors and VEGAMET are then not adjustable. This is due to an adjustment hierarchy beginning with VEGAMET or VEGALOG and ending with the sensor.

With the VEGAMET signal conditioning instrument
Sensor and VEGAMET signal conditioning instrument can be operated as with the adjustment program VVO with the 6 key adjustment field on the signal conditioning instrument. The adjustment is possible in the same function volume as with the adjustment program VVO on the PC.

With the adjustment module MINICOM
With the adjustment module MINICOM you adjust the individual sensor directly in the sensor or in the external indicating instrument VEGADIS 50. The adjustment module MINICOM with the 6 key adjustment field with text display enables the parameter adjustment of the sensor with an array of functions comparable to the adjustment program VVO or the VEGAMET signal conditioning instrument, however not the configuration of the measuring system.

The adjustment with the signal conditioning instrument is only possible with the adjustment program VVO or the 6 key adjustment field on the signal conditioning instrument.

6.2 Adjustment with the PC on VEGAMET

For connection of the PC to the signal conditioning instrument, the interface converter VEGACONNECT 2 is required. The PC communicates via the interface converter with the signal conditioning instrument and the connected sensor(s).

In the following setup and adjustment instructions you will find information on the following topics and adjustment points:

- Configuration
  - create new measurement loop
  - configuration info
- Parameter adjustment 1
  - adjustment
  - scaling
- Sensor optimisation
  - meas. environment
  - sound velocity
  - echo curve
  - false echo storage
  - measurement loop data
- Parameter adjustment 2 (optional)
  - linearisation
  - parameter adjustment outputs
- Display of measured value
- Simulation
- Backup

Note:
Keep in mind that you first have to log in a sensor in the configuration menu before you can continue with the parameter setting, and if necessary, carry out adjustments in the menu “Sensor optimisation”.

Beside the measured values, the adjustments signals are also transmitted digitally via the signal supply cable between sensor and VEGAMET. The adjustment program VVO can then communicate with VEGAMET and all connected sensors. In chapter "2.4 Configuration of measuring systems“ the connection of the PC to the different sensor arrangements is shown.

Before starting the setup:
Do not be confused by the many pictures, adjustment steps and menus on the following pages. Just carry out the setup with the PC step-by-step and you will soon no longer need the following pages. Whenever you should adjust or choose something, this is indicated in the following by a large black dot, like this:

- Choose …
- Start …
- Click to …
- Connect the standard output of your PC by the standard RS 232 interlink cable (9-pole) to VEGALOG.
- Now switch on the power supply of the processing system.

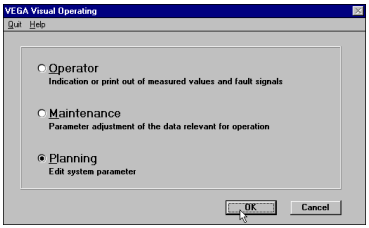
By this means, the actions to be carried out are clearly separated from supplementary information in the following adjustment instructions.

Start now:

- Connect the standard plug of VEGACONNECT 2 (9-pole) to the interface COM 1 or COM 2 of your PC.
- Insert the two small pin plugs of VEGACONNECT 2 into the CONNECT sockets on the front of the signal conditioning instrument.
- Now switch on the power supply of the signal conditioning instrument.

After approx. 1 … 2 minutes (self-test) the measuring system generally show the operating condition and the measured value.

- Now start the adjustment software VVO on your PC.



- Choose with the arrow keys or the mouse the item "*Planning*" on the entrance screen and click to "*OK*".

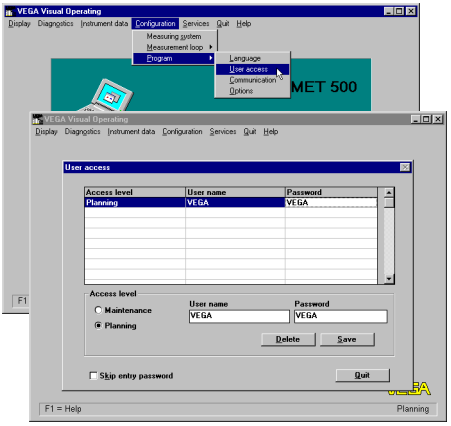
You are asked for the user identification.

- Enter under name "*VEGA*".
- Also enter "*VEGA*" under password.

The adjustment program VEGA Visual Operating (VVO), called in the following VVO, gets into contact with the connected system and indicates after a few seconds if and with which system a connection exists.

User identification

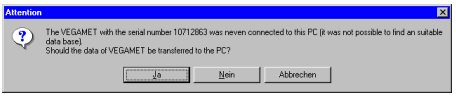
The preadjusted user identification can be modified at a later time in the menu „*User access*".



Note:
If you make no connection with the sensor, check the following:

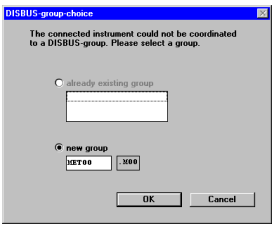
- Is the sensor being supplied with sufficient voltage (min. 20 V)?
- Did you inadvertently use a VEGACONNECT instead of the new VEGACONNECT 2?

If the adjustment software VVO gets in contact with the signal conditioning instrument for the first time, you will be asked if you want to transfer the data from the signal conditioning instrument to the PC.

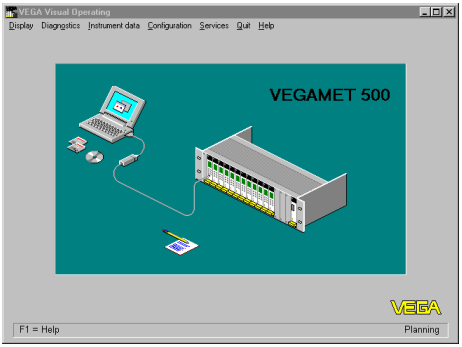


- Click to „*Yes*".

In the following menu window „*DISBUS-Netz-Auswahl*" you can give a name to the database or keep the proposed file name.



- Click to „*OK*“ and you are in the main menu window.



Note before starting the configuration:
The signal conditioning instruments are shipped with the sensor configuration you ordered with the signal conditioning instrument.

Generally you will use a preconfigured signal conditioning instrument. In the following menu „*Configuration*“, there are normally no adjustments necessary and you can continue directly with the menu „*Parameter adjustment*“. If your signal conditioning instruments are not preconfigured, start now with the section „*Configuration*“ and then continue with the adjustments in section „*Parameter adjustment*“.

Unaffected whether you set up a measuring system (consisting of sensor and VEGAMET signal conditioning instrument or VEGALOG processing system) with the adjustment software VVO or with the signal conditioning instrument, the adjustment procedure is always the same:
- first of all in the menu „*Configuration*“, you create a measurement loop and configure a measuring system and then
- in the menu „*Instrument data*“ you carry out the parameter adjustment of the sensor.

Configuration

During the setup of the measuring system you are confronted with two terms: "Configuration“ and "Parameter adjustment“. The meas. system is first set up with a configuration and then with a parameter adjustment.

Configuration

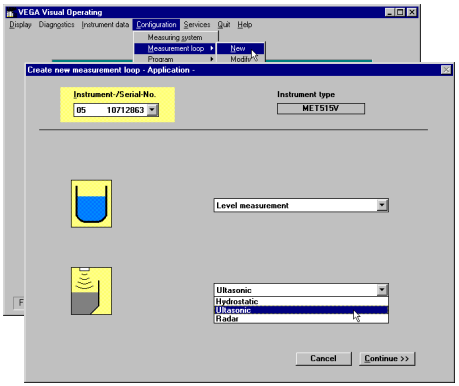
The term "Configuration“ means the basic adjustments of VEGAMET. You inform VEGAMET about the application (level measurement, gauge, distance …), the measurement loop name and the input channel. The configuration corresponds to an electronic wiring and labelling of your VEGAMET or just which sensor for what application and where.

Parameter adjustment

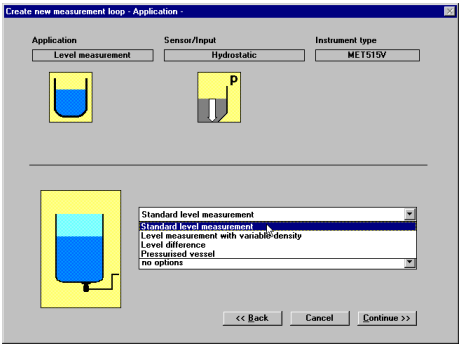
After the configuration, you carry out the parameter adjustment for each individual sensor. This means, to adjust the sensors to the respective operating range and to adjust to the actual application. You inform the sensor which product distance (which level) is "empty“ and which "full“. This is called adjustment. Here you choose in which physical unit (volume, mass) and unit of measurement (m^3, gal, liters …) the adjusted measured value should be outputted. In the submenu "Sensor optimisation“ you inform the sensor electronics about the actual environment, such as e.g. quick changes of the measured value, foam generation, gas stratification, solid or liquid.

Create new measurement loop

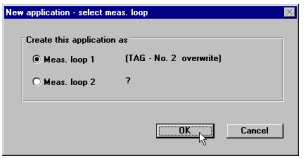
- Choose the menu „*Configuration/Measurement loop/New*“ and you are in the menu window „*Create new measurement loop - Application*“.



- Choose the parameter (*„level measurement“*, gauge or distance) and the sensor type (*„Pulse Echo“* for ultrasonic).
- Click to „*Continue*“.



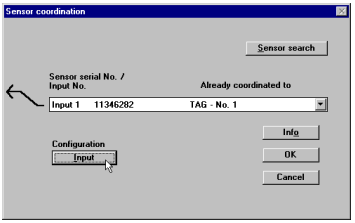
- Choose „Standard level measurement“ and „*no options*“.
- Click to „*Continue*“ and the menu window „*New application - Select measurement loop*“ opens.



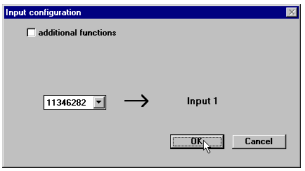
- Choose one of the two inputs of the VEGAMET signal conditioning instrument (VEGAMET 514V has only one sensor input) and click to „*OK*“.

After a few seconds, the menu window „*Create new measurement loop - Sensor configuration*“ opens.

- Click in the menu window „*Create new measurement loop - Sensor configuration*“ to „*Sensor coordination*“. The menu window „*Sensor coordination*“ opens.

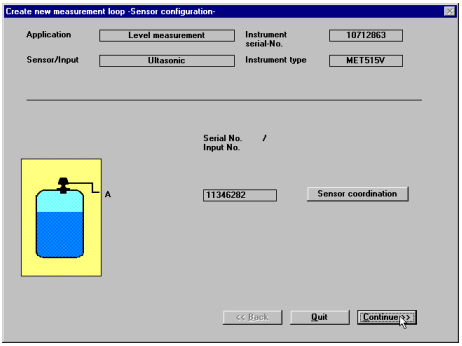


- Click to „*Sensor search*“.
- Then click to „*Input*“.

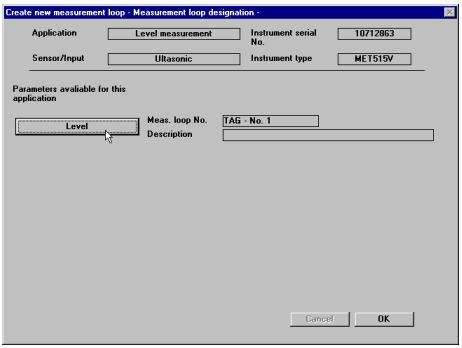


- Choose the serial number of the sensor to which you want to allocate e.g. input 1.
- Confirm with „*OK*“.
- Click in the menu window „*Sensor coordination*“ again to „*OK*“.

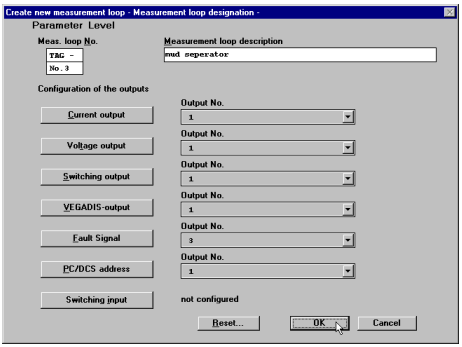
You are again in the menu window „*Create new measurement loop - Sensor configuration*“.



- Click to „*Continue*“…



- Click in the menu window „*Create new measurement loop - Measurement loop description*“ to „*Level*“.



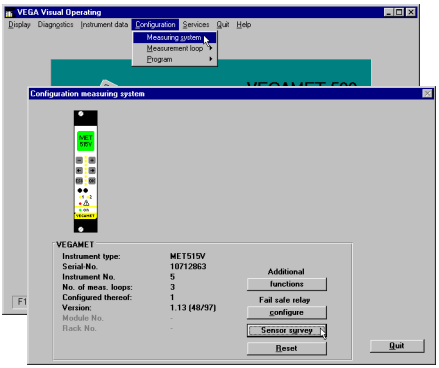
- Enter in the menu window „*Create new measurement loop - Measurement loop description*“ a measurement loop number and a measurement loop description.

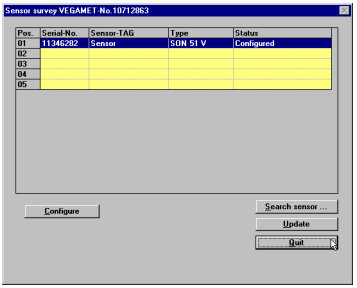
In this menu window you can choose, with which output signals your level should be outputted, e.g. as current, voltage, relay signal etc.

- Confirm with „*OK*“ and the previous menu window appears again.
- Click to „*Quit*“ and wait a moment until the adjustments are transmitted.

Configuration information

In the menu „*Configuration/Measuring system*“ - „*Sensor survey*“ you can check the configuration.





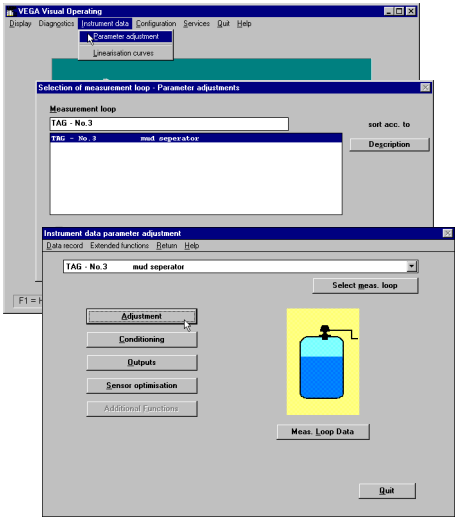
Parameter adjustment 1

In the menu "*Instrument data/Parameter adjustment*" you carry out all important sensor adjustments.

Adjustment

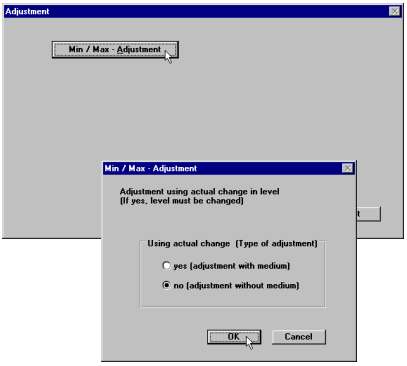
- Choose the menu "***Instrument data/Parameter adjustment***" and then the sensor you want to adjust.

If you have only configured one sensor on the signal conditioning instrument, naturally you will have a choice of only one sensor.



In the opening menu window, you now see the previously entered measurement loop names and the measurement loop descriptions.

- First choose „***Adjustment***".
- Click in the menu window „*Adjustment*" to „***Min/Max adjustment***".



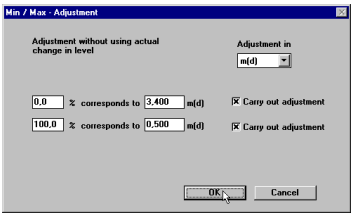
You can carry out the min./max. adjustment *"with medium"* (adjustment by means of the actual level) or *"without medium"* (without taking the actual level into consideration, i.e. with empty vessel).

Generally, you will carry out the adjustment without medium. Then you are not concerned about the actual vessel filling during adjustment. When you want to carry out the adjustment with medium, you have to carry out the min. adjustment with emptied (also partly emptied) vessel and the max. adjustment with filled (also partly filled) vessel. It is convenient and quick to carry out the adjustment without medium, as shown in the example.

- Choose "***no (adjustment without medium)***".
- Choose if you want the carry out the adjustment in *meters* (m) or in *feet* (ft).
- Enter a distance for the upper and lower level and the volume in % corresponding to each distance.

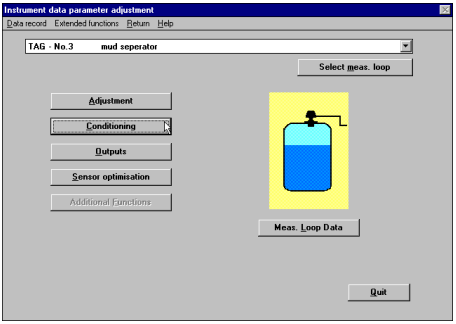
In the example, the 0 % filling is at a product distance of 3.400 m and the 100 % filling at a product distance of 0.500 m.

Note:
The sensor can only detect levels within the defined operating range. For the detection of levels outside the operating range, e.g. new adjustment, it is necessary to correct the operating range in the menu "*Sensor optimisation/Meas. environment*".



- Confirm your adjustments with "*OK*" and you are again in the menu window "*Adjustment*".
- Click in the menu window "*Adjustment*" to "*Quit*".

You are again in the menu window "*Instrument data parameter adjustment*".



Now the sensor electronics has two characteristics points, one for min. and one for max., out of which a linear correlation between product distance and the percentage filling of a vessel is generated.

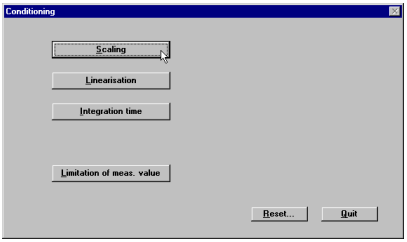
Naturally the characteristics point must not be at 0 % and 100 %, however the distance should be as big as possible (e.g. at 20 % and at 80 %). The difference between the characteristics points for the min./max. adjustment should be at least 50 mm product distance. This is a theoretical value, because if the characteristics points are too close together, the possible measuring error increases. Ideal would be, to carry out the adjustment as shown in the example, at 0 % and at 100 %.

In the menu "*Instrument data/Parameter adjustment/Conditioning/Linearisation*" you can enter later, if necessary, a correlation between product distance and percent value of volume other than linear (see later subitem linearisation).

Scaling

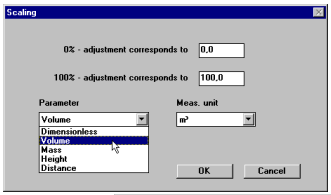
- Click in the menu window "*Instrument data parameter adjustment*" to "*Conditioning*".

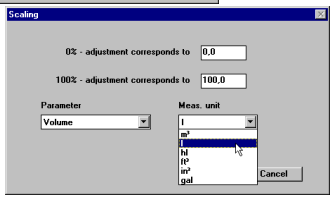
The menu window "*Conditioning*" opens.

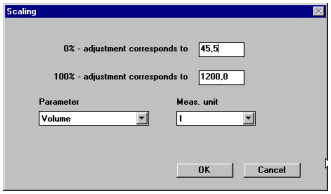


- Click to "*Scaling*".

In the menu "*Scaling*" you enter the actual 0 % and 100 % values of the parameter and their unit. You thereby inform the sensor, e.g. that at 0 % filling there are still 45 liters and at 100 % filling 1200 liters in the vessel. The sensor display then shows with empty vessel (0 %) 45 liters and with full vessel (100 %) 1200 liters.







As parameter you can choose *"dimensionless* (plain numbers), *volume, mass, height and distance"* and assign an appropriate measuring unit (e.g. l, hl). The sensor display then shows the measured value in the selected parameter and unit.

- Save the adjustments in the menu "*Scaling*" by clicking "*OK*".

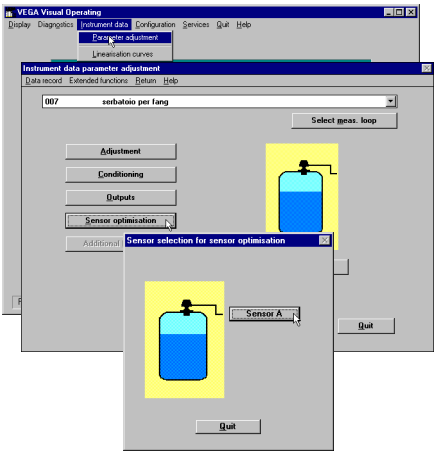
The adjustments are now transferred to the sensor and you are again in the menu window "*Conditioning*".

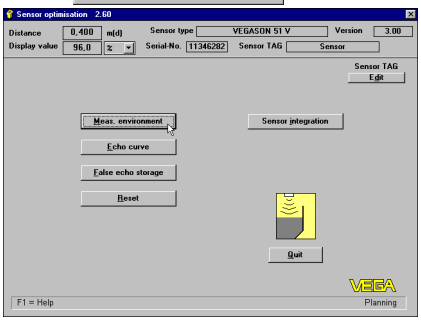
Sensor optimisation

In the menu "Sensor optimisation" you can adapt the sensor to the environment. Here you carry out special optimising adjustments and optimise, e.g. by means of the echo curve, the mounting location of the sensor.

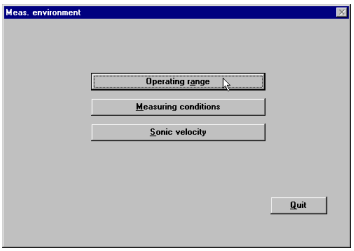
Meas. environment/Operating range

- Choose the menu "*Instrument data parameter adjustment*"
- Choose in the menu window "*Instrument data parameter adjustment*" the menu item "*Sensor optimisation*" and click to "*Sensor A*".
- First click to "*Meas. environment*".





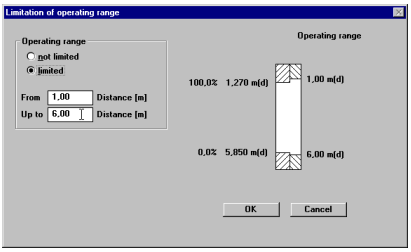
The menu window "Meas. environment" opens.



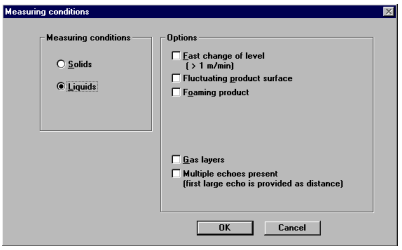
With the menu item "*Operating range*" you can define the operating range of the sensor deviating from the "*Min/Max adjustment*". By default, the operating range corresponds otherwise to the min./max. adjustment (span).

Generally, it is better to choose the operating range approx. 5 % bigger than the adjusted measuring range (span) determined by the min./max. adjustment.
In the example:
- Min. adjustment to 1.270 m,
- Max. adjustment to 5.85 m.

In the example you would have adjusted the operating range from 1 m to 6 m.



- Save the adjustments and quit the menu window "*Limitation of the operating range*".
- Click to „*Measuring conditions*".
- In the menu window "*Measuring conditions*" you click on the options corresponding to your application.



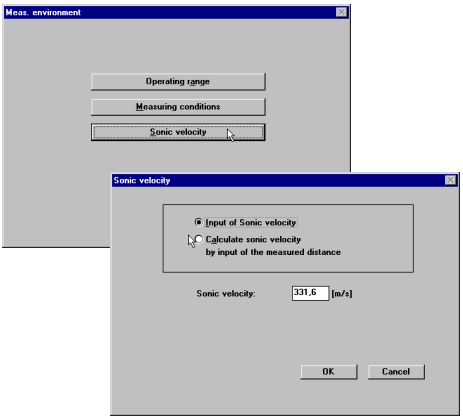
- Confirm with "*OK*".

After a few seconds of saving during which the adjustments are permanently saved in the sensor, you are again in the window "*Meas. environment*".

Sonic velocity

When measuring in a gas composition deviating from air, e.g. pure nitrogen, the sonic velocity will change. Without correction, this would distort the measuring result.

In the menu "*Sonic velocity*" the sonic velocity can be adapted to the correct value in case of another gas composition.

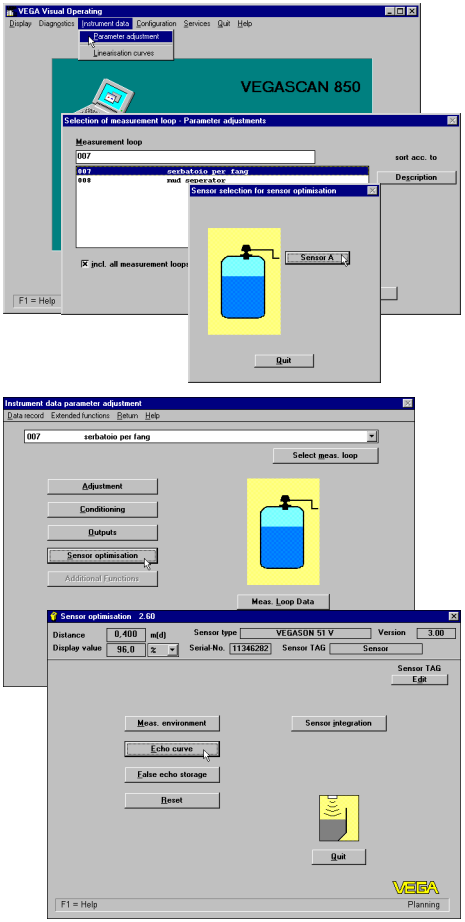


- Confirm with "*OK*".
- Click in the menu window "*Meas. environment*" to "*Quit*".

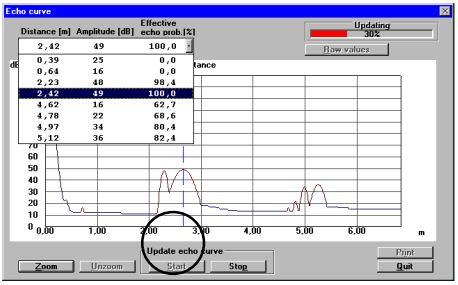
You are again in the menu window "*Sensor optimisation*".

Echo curve

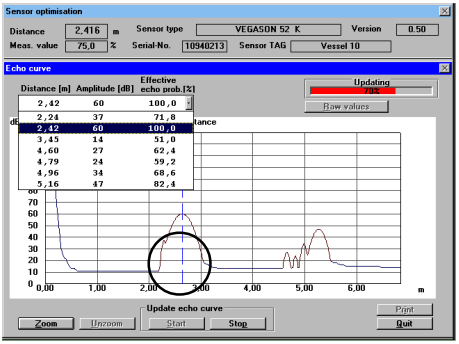
If, due to vessel installations, you expect strong false echoes, a correction (if possible) of the mounting location and orientation (during simultaneous monitoring of the echo curve) can help localise the false echoes and reduce their intensity. With the menu item "*Echo curve*" in the menu window "*Sensor optimisation*" you can see the form and the intensity of the detected ultrasonic echoes.



In the illustration, you see the echo curve (before correction of the sensor orientation) with a false echo nearly as large as the product echo.



In the next illustration you then see the echo curve after optimum directing of the sensor to the product surface and away from a large false echo source (sensor axis perpendicular to the product surface). The false echo, caused e.g. by a strut, is now reduced by more than 10 dB and will no longer influence the measurement.

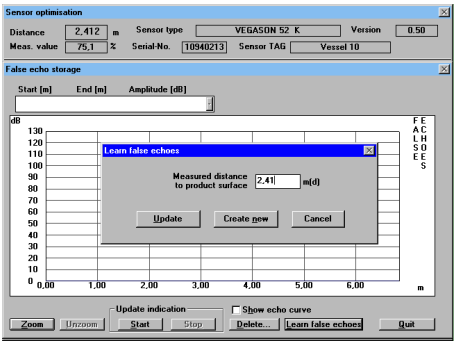


- Quit the menu window "*Echo curve*" with "*Quit*".

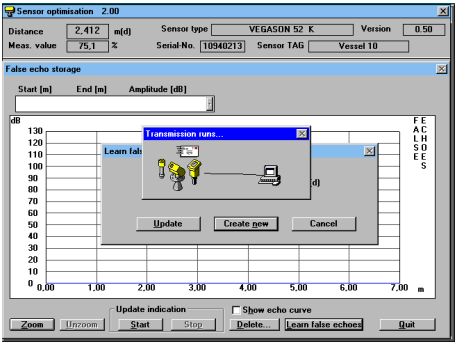
False echo storage

With the menu item "*False echo storage*" in the menu "*Sensor optimisation*" you can authorise the sensor to save false echoes. The sensor electronics then saves the false echoes in an internal database and assigns them a lower level of importance than the useful echo. The false echo storage should be carried out with empty vessel.

- Click in the menu window to "*Sensor optimisation*" to the menu item "***False echo storage***". A small window opens.
- Now click in the opening menu window "*False echo storage*" to "***Learn false echoes***".
- Enter here the verified product distance and click to "***Create new***".



You hereby authorise the sensor to mark all echoes before the product echo as false echoes. This prevents the sensor from erroneously detecting a false echo as level echo.



- Click to "***Show echo curve***".

The curve and the false echo marking are shown.

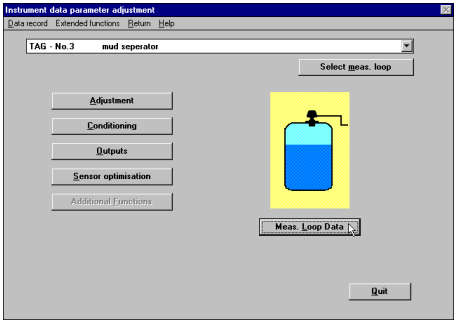
- Quit the menu with "***Quit***".

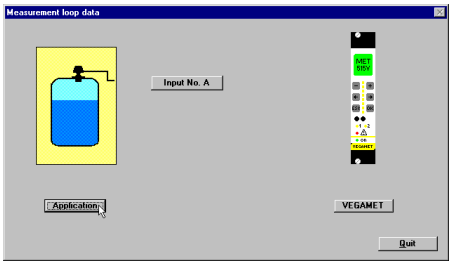
You are again in the menu window "*Sensor optimisation*". With the menu item "*Reset*" you reset all options out of the menu "*Sensor optimisation*" to default.

- Quit the menu window "*Sensor optimisation*" with "***Quit***" and the menu window "*Sensor optimisation sensor selection*" also with "***Quit***".

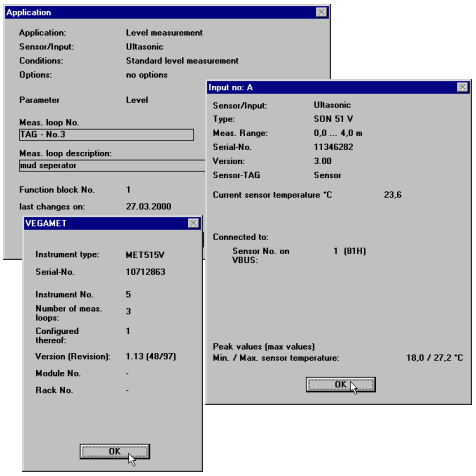
You are then in the initial menu window "*Instrument data parameter adjustment*".

- Click to the menu item „***Meas. loop data***".





- Click to „*Application*“, to „*Input no. A*“ and „*VEGAMET*“, to get detailed information to your measurement loop in the information windows.



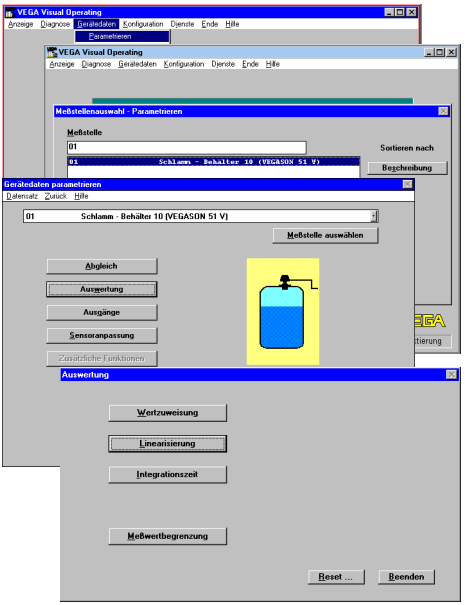
- Close the information windows.
- Quit the menu „*Meas. loop data*“.
- Click in the menu window „*Instrument data parameter adjustment*“ to *Quit*“.

You are again in the main menu window.

Parameter adjustment 2

Linearisation

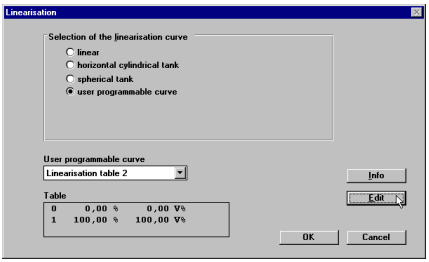
The relation between level and filling volume is described with so-called linearisation curves. If, in your vessel, there is a correlation other than linear between level ("*Percentage value*“ of the level) and the filling volume (linearised value of the filling volume), choose in the menu window "*Conditioning*“ the menu item "*Instrument data/Parameter adjustment/Conditioning*“.



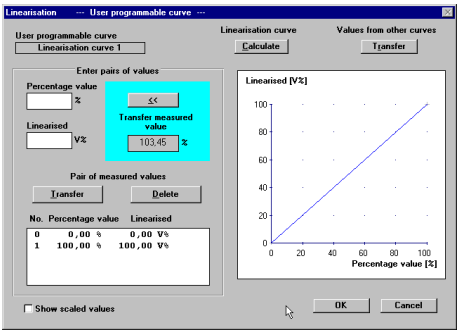
- Click in the menu window "*Conditioning*“ to the menu item "*Linearisation*“.

The menu window "*Linearisation*“, in which a correlation between percentage value of the level and the percentage value of the filling volume is preadjusted. Beside the two programmed linearisation curves "*Horizontal cylindrical tank*“ and "*Spherical tank*“ you can also enter "*user programmable curves*“. Linear means there is a linear correlation between level and volume.

User programmable linearisation curves

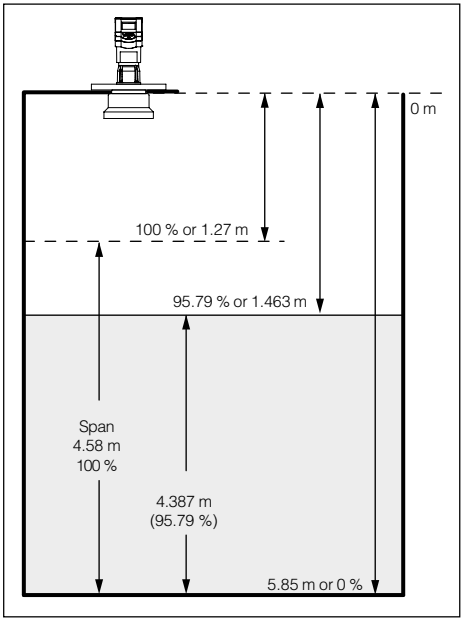


- Click to "*User programmable curve*" to enter your own vessel geometry or a user programmable filling curve.
- Click to "*Edit*".



The user programmable linearisation curve is generated by index markers. Each index marker consists of one value pair. A value pair is generated out of a value "*Linearised*" and a value "*Percentage value*". "*Percentage value*" represents the percentage value of the level. "*Linearised*" represents the percentage vessel volume at a certain percentage value of the level.

In the field "*Transfer measured value*" the current level as percent of the adjusted span is displayed. The measuring span has already been adjusted with the min./max. adjustment. In our example, the measuring span is 4.58 m and is in the range of 5.85 m (empty) up to 1.27 m (full), see the following illustration.



5.85 m meas. distance correspond to 0 % level. 1.27 m meas. distance correspond to 100 % level. The measuring span is therefore 4.58 m (5.85 m – 1.27 m = 4.58 m).

The percentage value of 95.79 % means that now 4.387 m of the adjusted measuring span (4.58 m) are reached:
4.58 • 0.9579 = 4.387 m.

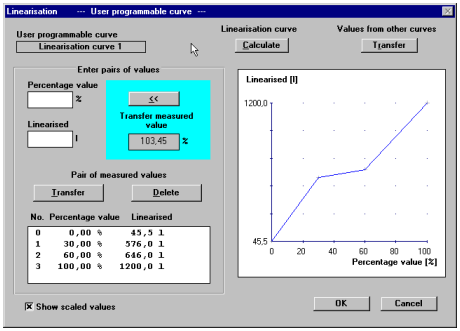
The distance (product distance) outputted by the sensor, in case you have chosen "*distance*" as output parameter, is then:
5.85 – (4.58 • 0.9579) = 1.463 m.

If the index markers or value pairs of your vessel are not known, you have to define the linearisation curve by incremental filling or calculate it with the vessel calculation program of VVO.

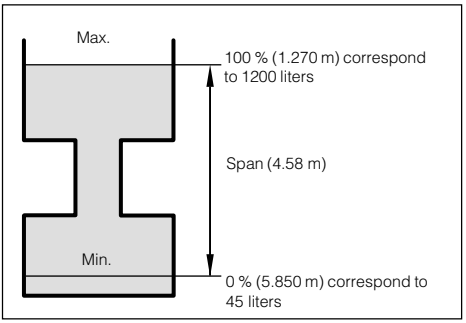
Defining the linearisation curve by incremental filling

In the characteristics of the example, you see four index markers or value pairs. There is always a linear interpolation between the index markers. The example vessel consists of three cylindrical segments of different height and diameter. The middle segment has a considerably smaller diameter.

- Click the check box "*Show scaled values*", to have the selected measuring unit displayed on the y-axis (bottom left in the menu window).



Index marker 1 is at 0 % filling (*percentage value [%]*), corresponding in the example to an actual distance to the product surface of 5.850 m (empty vessel). The volume quantity is 45 liters (fluid remaining in the vessel).
Index marker 2 is at a filling level of 30 % (30 % of the meas. distance of 1.270 m ... 5.850 m). At a filling level of 30 %, there are 576 liters in the vessel (in our example).
Index marker 3 is at a filling level of 60 %. At this filling level there are 646 liters in the vessel.
Index marker 4 is at a filling level of 100 % (product distance 1.270 m), where 1200 liters are in the vessel.

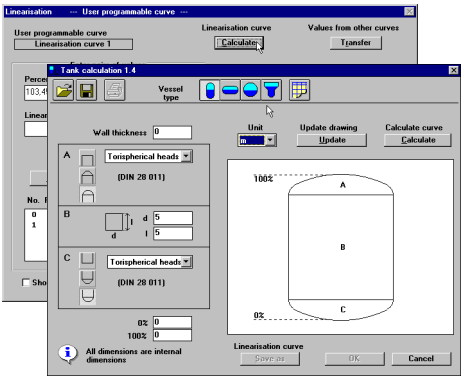


Max. 32 index markers can be entered per linearisation curve (value pairs).

Calculating the linearisation curve

(using previous tank example)

In the menu window "*Linearisation -- user programmable curve --*" you can start the vessel calculation program. With the vessel calculation program you can calculate (using dimensions from the technical drawings of the vessel) the correlation of filling height to filling volume. If the curve is defined this way, gauging by incremental filling is not necessary - your sensor will output volume as a function of level.

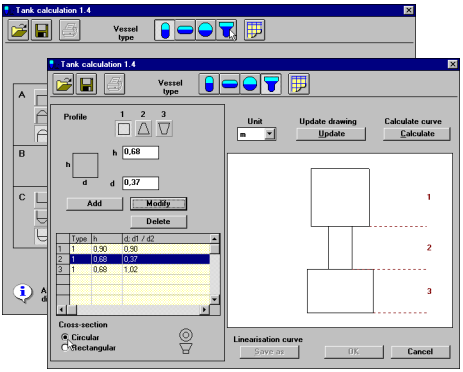


- Click to "*Calculate*".

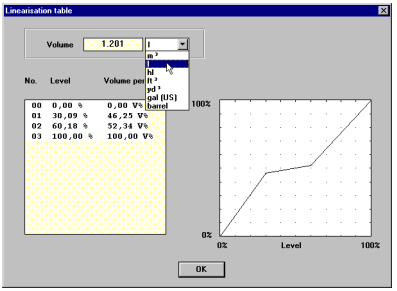
The tank calculation program starts. In the top left corner you choose the vessel type (upright tank, cylindrical tank, spherical tank, individual tank form or matrix). When choosing matrix, you can enter a user-programmable linearisation curve by means of index markers. This corresponds to the input of value pairs (linearisation points), as previously described.

In the following example, the tank calculation program calculates the linearisation curve of a vessel, corresponding to the vessel in the previous gauging example.

- Click to individual tank form and choose three round tank segments with the dimensions 0.9 m • 0.9 m (height by diameter), 0.68 m • 0.37 m and 0.68 m • 1.02 m (this tank form corresponds to the tank form of the gauging example).

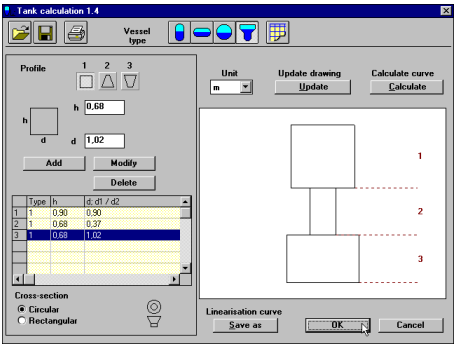


- Click to "Calculate".



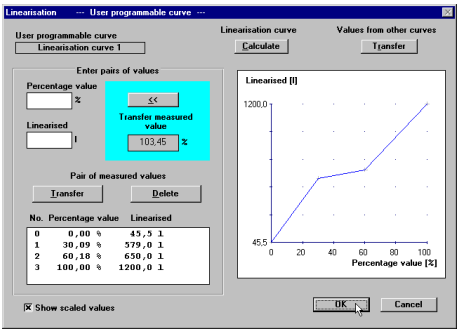
After a short calculation time, the levels in percentage of span and the respective volume percentage will be shown. The outputted curves show the correlation in a diagram.

- Quit the linearisation table with "*OK*".



You are again in the menu window "*Tank calculation*".

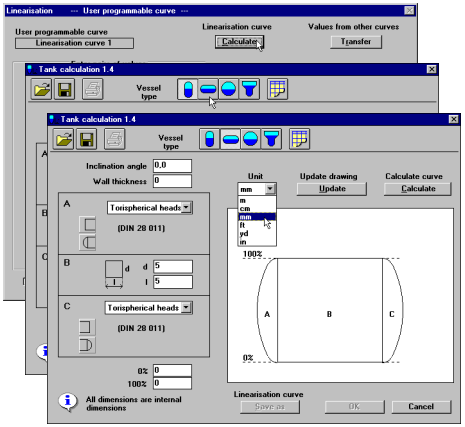
- Click to "*OK*" to save the tank calculation.



You are again in the menu window "*Linearisation -- user programmable curve --*". The volume percent values to the percentage values of the level are shown. When clicking the bottom left menu window "*Show in scaled values*", the scaled litre values will be displayed depending on the adjustment in the menu "*Instrument data/Parameter adjustment/Conditioning/Scaling*".

Calculate cylindrical tank

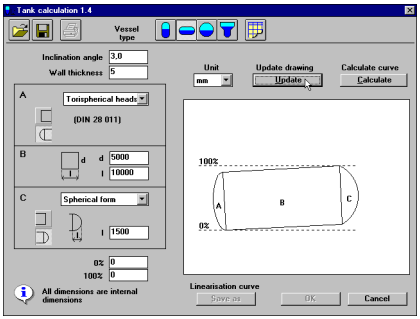
- Click in the menu window "*Linearisation -- user programmable curve --*" to "***Calculate***" and in the menu window "*Tank calculation*" to the symbol for cylindrical tanks.



The menu window for the adjustment of the cylindrical tank opens.

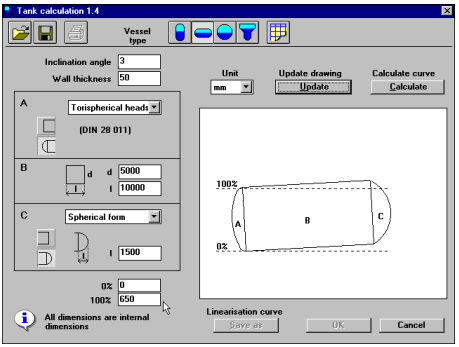
- Choose the measuring unit which should be used for the input of the vessel dimensions, e.g. mm.

The following example shows a cylindrical tank, which inclined by 3°, has a cylinder length of 10000 mm, at a diameter of 5000 mm. The cylindrical tank has a 1500 mm wide, spherical form at the right end and a dished tank end at the left.



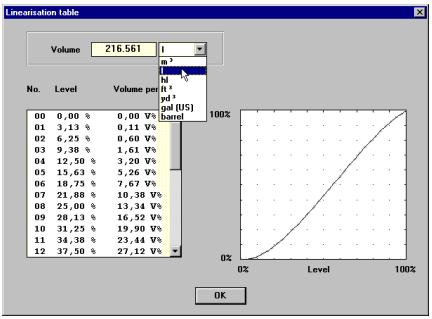
Note:
In the bottom left corner in the menu window "*Tank calculation*" you find the information "*All dimensions are internal dimensions*".

The calculation program calculates by means of the vessel inner dimensions the vessel volume. The adjustment of the wall thickness is not necessary for the calculation of the dished boiler end as its mathematical calculation is based on the outer dimension. Above the information "*All dimensions are internal dimensions*", you will find two fields with the percentage values 0 % and 100 %. Here you can shift the 100 % line or the 0 % line. In the example, the 100 % filling line was defined at a distance of 650 mm from the upper vessel edge (inner).



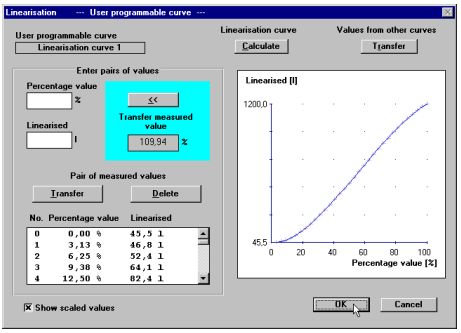
- Click to "***Calculate***".

You will get the calculated linearisation table after a short calculation time. By means of 32 linearisation points, a function correlating vessel volume to filling height is outputted. The example vessel has a filling of 216561 liters at the 100 % line or 216.6 m³. It is possible to output the volume in barrels, gallons, cubic yards or cubic feet.



There is a linear interpolation between the linearisation points.

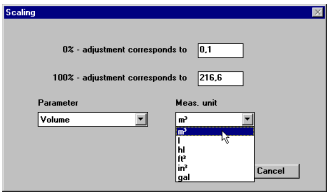
- Click to "*OK*" and you are again in the menu window "*Tank calculation*".
- Again click in the menu window "*Tank calculation*" to "*OK*" and you are in the linearisation menu.



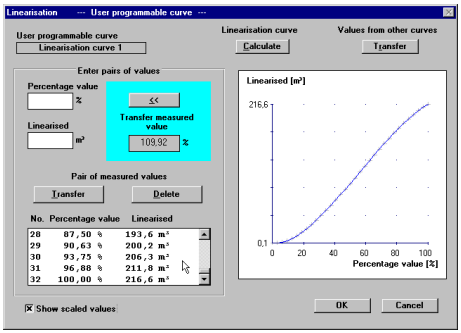
Here the calculated linearisation curve is again outputted. The volume information under "*Linearised*" now corresponds no longer to the calculated volume of the tank calculation program. Why?

In the menu "*Scaling*" (Instrument data/Conditioning/Scaling) you entered that at 0 % filling there are 45 liters in the tank and at 100 % filling 1200 liters. The geometry of the calculated cylindrical tank is reduced to a size that has a volume of only 1200 liters. The linearisation curve of the calculated vessel is therefore modified to fit the volume data you entered in the menu "*Scaling*".

If the true content of the calculated vessel should be outputted, the volume that was determined in the tank calculation program must be entered in the menu "Scaling".



The sensor then outputs the actual filling volume by means of the adjusted vessel dimensions.



- Quit the menu with "*OK*".
- Confirm with "*OK*" and your individual linearisation curve is saved in the sensor.

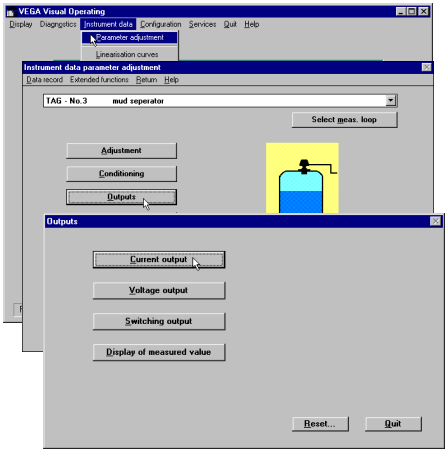
Again in the menu window "*Conditioning*", you can enter with the menu item "*Integration time*" a measured value integration. This is recommended for agitated product surfaces, to prevent the measured value indication and output from changing constantly.
As a standard feature, an integration time of 0 seconds is preset.

- Quit the menu with "*OK*"., you are again in the menu window "*Instrument data parameter adjustment*".

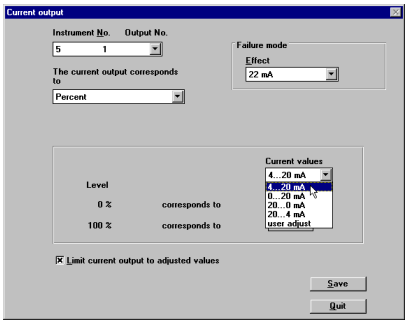
- Quit the menu window with "*OK*".

Parameter adjustment outputs

- Choose „*Instrument data parameter adjustment*“.
- Choose in the menu window „*Instrument data parameter adjustment*“ the menu item „***Outputs***“.

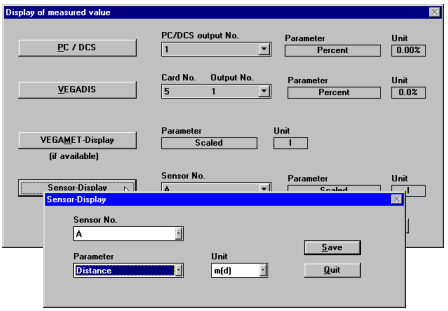


- You are in the menu window „*Outputs*“. Click to „***Current output***“ to adjust the signal condition of the 0/4 … 20 mA output signal.

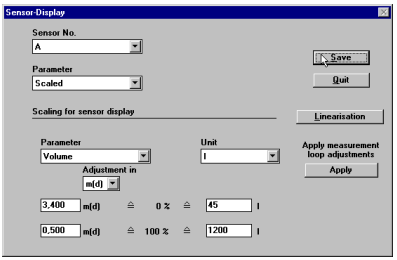


- If you have carried out adjustments in this window, click to „***Save***“.
- If you want to leave the adjustments unchanged, click to "***Quit***“ and you are again in the menu window „*Outputs*“.

- In the menu window "*Outputs*“ you click to "***Display of measured value***“ and choose „***Sensor-Display***“.



- Choose under „*Sensor no.*“ „A“ and under „*Parameter*“ „***Scaled***“.
- Choose „*Scaled*“, „***Volume***“, if you want to have the values displayed, e.g. in litres. In the example, a level of 45 … 1200 liters would have been displayed.
- Enter the meas. distance in m which you have adjusted in the Min/Max-adjustment and the appropriated litre values corresponding to the min. and max. value.



- Click to „***Save***“.
- Click in the window „*Sensor-Display*“ to „***Quit***“ .
- Click in the window „*Display of measured value*“ to „Quit“.

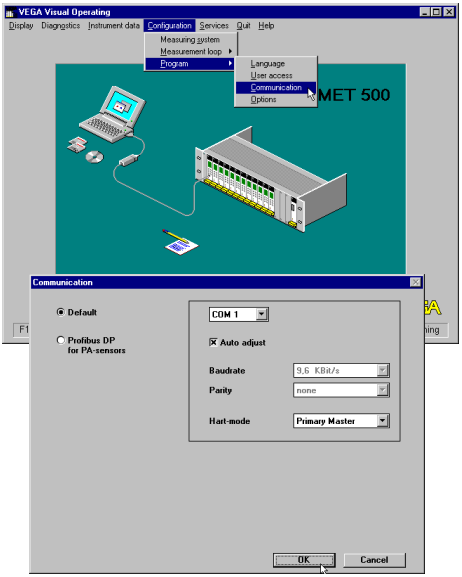
You are again in the menu window „*Outputs*“.

- Click in the menu window „*Outputs*“ to „***Quit***“.

You are again in the menu window „*Instrument data parameter adjustment*“.

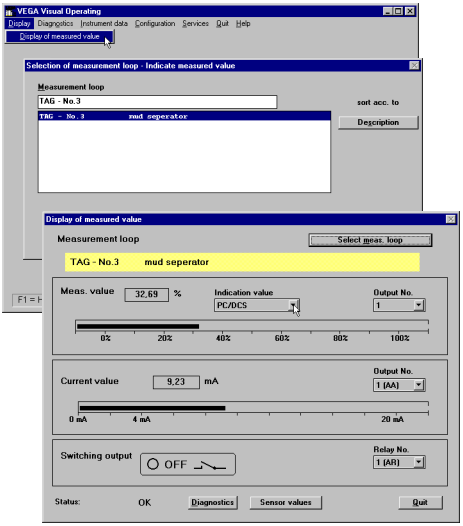
Change COM interface

In the menu „*Configuration/Program/Communication*“ you can adjust the interface parameters of your PC or change the used COM port.

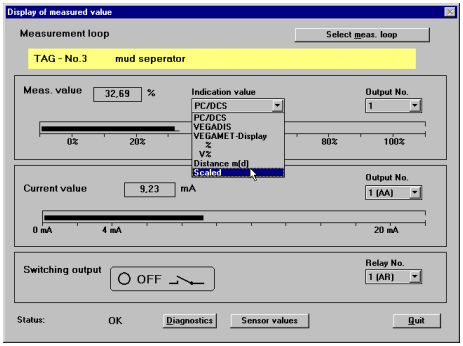


Show measured value

- Click in the main menu window to the menu "*Display/Display of measured value*“ and choose the measurement loop (in the example only one is available).

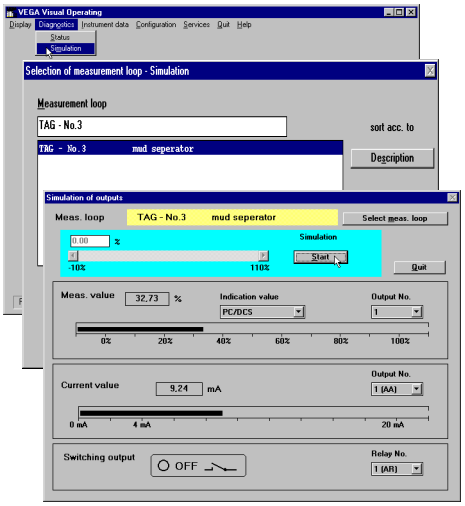


- Choose in the line "*Indication value*“ the output „***Scaled***“ and e.g. the measured value will be displayed in liters and volume percent as well as the actual signal current in the
0/4 … 20 mA signal cable.



Simulation

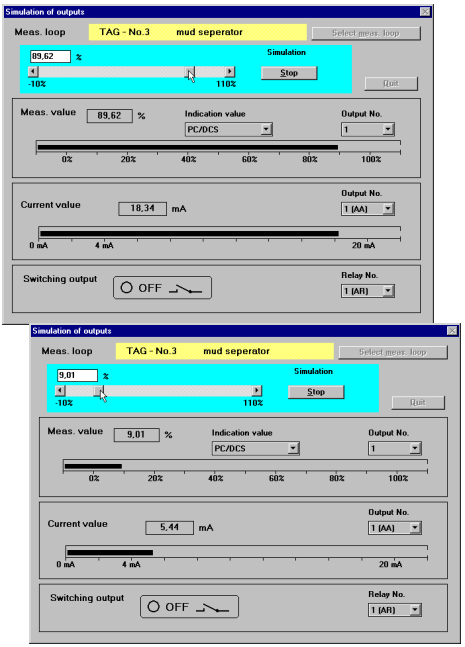
- Click to the menu "*Diagnostics/Simulation*" and choose the measurement loop (in the example only one is available).



The menu window "*Simulation of outputs*", similar to the previous menu window, opens. In this menu window however, you can set the filling of the vessel or the signal current and the indication to any value (simulate measured value).

First of all, the actual measured value and the signal current are displayed.

- Click to "*Start*" in the turquoise window segment.

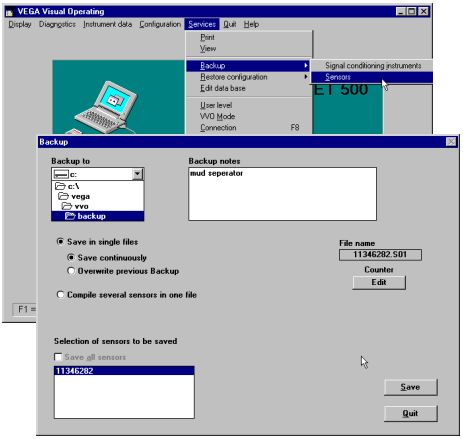


The grey scroll bar becomes active. With this scroll bar your can modify the measured value in the range of -10 % ... 110 % and thereby simulate the filling or emptying of the vessel. In the field of the turquoise window cutout you can enter any % value for the filling percentage.

Note:
The simulated measured value is outputted during adjustment with the PC until you terminate the simulation mode.

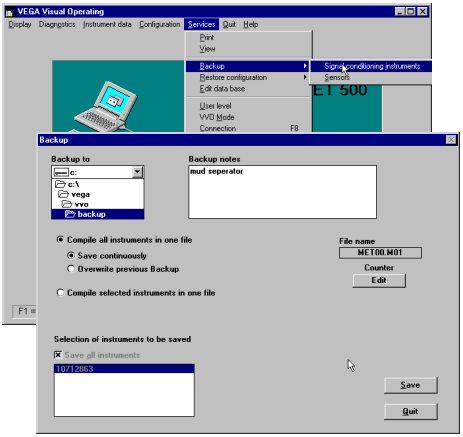
Backup

- Click to „*Services/Backup/Sensors*“.



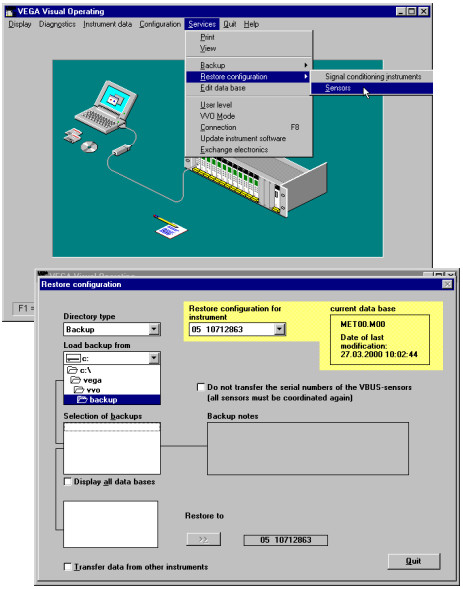
In the menu field „*Backup*“ the sensor with the serial number is displayed. You can save the sensor individually or in groups with all settings in any directory on your PC. It is also possible to add small notes to each backup.

Furthermore you can save the settings of the VEGAMET signal conditioning instrument:



Saved sensor data can be transferred to other sensors at a later time. If e.g. you have a system with several of the same storage vessels and identical sensors, it is sufficient, to configure one sensor, to save the settings and then transfer them to the other sensors.

- Choose the menu „*Services/Restore configuration/Sensors*“.



In the yellow window cutout, you choose a sensors (or a signal conditioning instrument) which should be overwritten with the settings of another sensor.

Choose in the field „*Selection of backup*“ the serial number of the sensor of which you want to take over the settings. With „*Restore after*“ you transfer these sensor settings to the sensor you have chosen in the yellow window cutout.

6.3 Adjustment with the adjustment module MINICOM

Beside the PC, the ultrasonic sensors VEGASON 54V ... 56V can also be adjusted with
- the signal conditioning instrument
- or detachable adjustment module MINICOM.

For the adjustment with VEGAMET signal conditioning instrument all adjustment options as with the PC are available. The adjustment, however, is different in the appearance, but not in the functions.

With the adjustment module MINICOM only the sensor-relevant adjustment are possible, such as e.g. adjustment, operating range, measuring conditions, sensor scaling or false echo memory. However, all adjustment steps relating to the configuration of the VEGAMET signal conditioning instrument and their signal processing (configuration of the inputs and outputs, linearisation curves, simulation ...) are not possible.

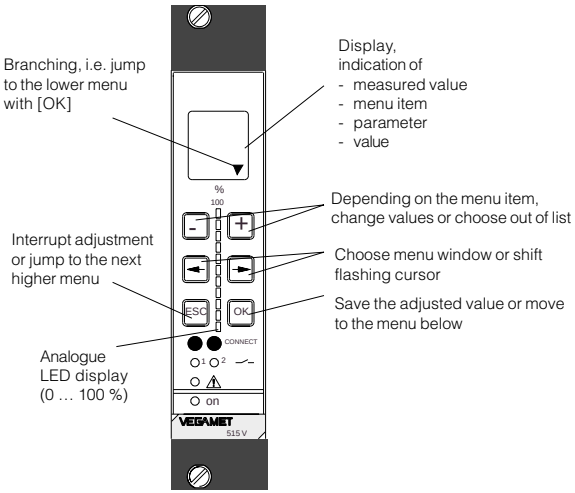
The adjustment of VEGAMET and MINICOM is identical. Adjustment is made with six keys. A small display shows you, apart from the measured value, a short message on the menu item or on the value of a menu adjustment.

The information volume of the small display, however, cannot be compared with that of the adjustment program VVO, but in conjunction with the following menu schematic of VEGAMET 515V and MINICOM the adjustment will not be a problem. Perhaps the adjustments can be carried out more quickly and directly with the small adjustment field than with the PC.

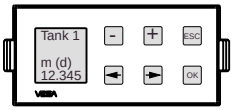
Note:
You will find the menu schematic for VEGAMET 514V in the operating instructions VEGAMET 514V.

Indicating and adjustment surfaces

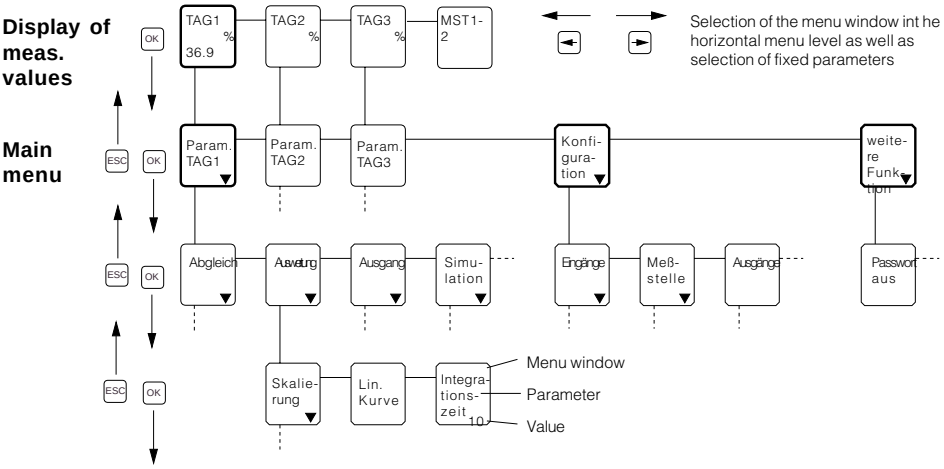
VEGAMET signal conditioning instrument



Adjustment module MINICOM



Adjustment structure



Adjustment steps

On page 72 ... 79 you can find the complete menu schematic of the VEGAMET 515V signal conditioning instrument as well as of the adjustment module MINICOM. The menu schematic of the VEGAMET 514V signal conditioning instrument is nearly identical. Set up the sensor in the numbered sequence. The respective numbers are stated in the menu schematics. The items in brackets can be adjusted beside the VEGAMET signal conditioning instrument also with the adjustment module MINICOM.

1. Configuration of the input (as a rule, already preconfigured)
2. Configuration of the measurement loop (as a rule, already preconfigured)
3. Measurement in gases
4. Operating range
5. Meas. conditions
6. Min/Max adjustment
7. Conditioning/Scaling VEGAMET
8. False echo memory (only required when errors occur during operation)
9. Indication of the useful and noise level
10. Conditioning/Scaling of the sensor display
11. Outputs

Short explanations to the setup steps 1 ... 11 follow.

1. Configuration of the input

First of all, you have to inform the signal conditioning instrument (only VEGAMET 515V) to which input (input 1 or 2) the sensor is connected.

2. Configuration of the measurement loop

(see menu schematic page 74)

3. Measurement in gases

Adjustment is only necessary when the measurement is made in gases (Co_2, He, etc.) deviating from air. In case of measurement in gases, sound the distance of the sensor to the product surface and enter it in the menu item "Measurement in gases". The sensor can then take the modified sonic velocity in gases (as opposed to air) and output correct levels.

4. Operating range

Without special adjustment, the operating range corresponds to the measuring range. The measuring range has already been adjusted with the min./max. adjustment. Generally it is useful to choose a slightly bigger (approx. 5 %) operating range than the measuring range.

Example:
Min./max. adjustment: 0.500 ... 3.500 m;
adjust operating range to approx.
0.400 ... 3.600 m.

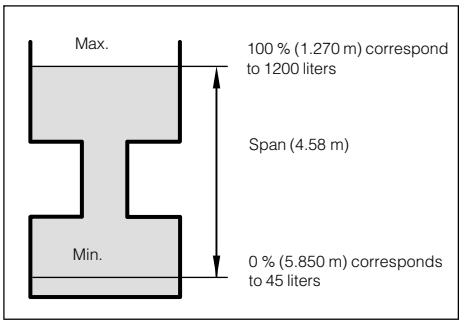
5. Meas. conditions

(see menu schematic page 78)

2. Adjustment

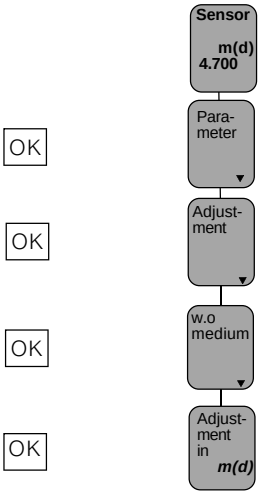
Under the menu item "*Adjustment*" you inform the sensor with which measuring range it should operate.

You can carry out the adjustment without and with medium. Generally you will carry out the adjustment without medium, as you can then adjust without a filling cycle.



Adjustment without medium
(adjustment independent of the actual level)

Key adjustment — Display indication



(min. adjustment)

\+ — The distance indication flashes and you can choose "feet" and "m".

OK — Confirm the adjustment with "*OK*".

\+ or – — With"*+*" and "–" you adjust the percentage value for the min. value or the lower level (example 0.0 %).

OK — The adjusted percentage value is written in the sensor and the distance corresponding to the percentage value flashes.

\+ or – — With the "*+*" or "–" key you can assign a level distance (example 5.85 m) to the previously adjusted percentage value. If you do not know the distance, you have to do a sounding.

OK — The adjusted product distance is written in the sensor and the display stops flashing.

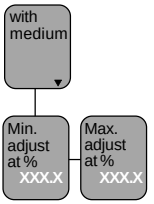
You thereby adjusted the lower product distance as well as the percentage filling value corresponding to the lower product distance.

(max. adjustment)

The max. adjustment (upper product distance) is made in the same way (example: 100 % and 1.270 m).

Note:
The difference between the adjustment values of the lower product distance and the upper product distance should be as big as possible, preferably at 0 % and 100 %. If the values are very close together, e.g. lower product distance indication at 40 % (3,102 m) and upper product distance adjustment at 45 % (3.331 m), the measurement will be inaccurate. A characteristics curve is generated from the two points. Even the smallest deviations between actual product distance and entered product distance will considerably influence the slope of the characteristic curve. When the adjustment points are too close together, small errors multiply to considerably larger errors at the output of the 0 % or the 100 % value.

Adjustment with medium



Fill the vessel e.g. to 10 % and enter 10 % in the menu "*Min. adjust*" with the "*+*" and "–" keys. Then fill the vessel, e.g. to 80 % or 100 % and enter 80 % or 100 % in the menu "*Max. adjust*" with the "*+*" and "–" keys. If you do not know the distance, you have to calculate it by incremental filling.

OK — The indication stops flashing and the adjustment will be saved.

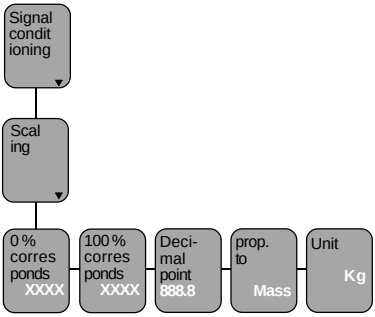
You have entered the min. value.

(max. adjustment)

Enter the max. adjustment like the min. adjustment with „+", „–" or „OK" (example: 1.270 m).

7. Conditioning/Scaling VEGAMET

Under the menu item "*Conditioning/Scaling*" you choose the product distance at 0 % and at 100 % filling. Then you enter the parameter and the physical unit as well as the decimal point.



Enter in the menu window "*0 % corresponds*" the figure of the 0 % filling. In the example of the adjustment with the PC and the adjustment software VVO this would be 45 for 45 liters.

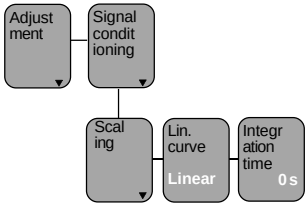
- Confirm with "*OK*".

With the "—>" key you change to the 100 % menu. Enter here the value of your parameter corresponding to a 100 % filling. In the example 1200 for 1200 liters.

- Confirm with "*OK*".

If necessary, choose a decimal point. However, note that only max. 4 digits can be displayed. In the menu "*prop. to*" you choose the parameter (mass, volume, distance…) and in the menu "*Unit*" the physical unit (kg, l, ft^3, gal, m^3 …).

Linearisation:



VA linear correlation between the percentage value of the product distance and percentage value of the filling volume is preadjusted. With the menu "Lin. curve" you can choose between linear, spherical tank and cylindrical tank. The creation of one's own linearisation curve is only possible with the PC and the adjustment program VVO.

8. False echo storage

A false echo storage is always useful when unavoidable false echo sources (e.g. struts) must be minimised. By creating a false echo storage, you authorise the sensor electronics to note the false echoes and save them in an internal database. The sensor electronics treats these (false) echoes differently from the useful echoes and filters them out.

9. Useful and noise level

In the menu

you get important information on the signal quality of the product echo. The higher the "S-N" value, the more reliable the measurement (menu diagram MINICOM).

Ampl.: means amplitude of the level echo in dB (useful level)
S-N: means Signal-Noise, i.e. the useful level minus the level of the background noise

The bigger the "S-N" value (difference between the amplitude useful level and the noise level), the better the measurement:

> 50 dB	Measurement excellent
40 … 50 dB	Measurement very good
20 … 40 dB	Measurement good
10 … 20 dB	Measurement satisfactory
5 … 10 dB	Measurement sufficient
< 5 dB	Measurement poor

Example::
Ampl. = 68 dB
S-N = 53 dB

68 dB – 53 dB = 15 dB noise level

53 dB signal level difference indicates very high measurement reliability.

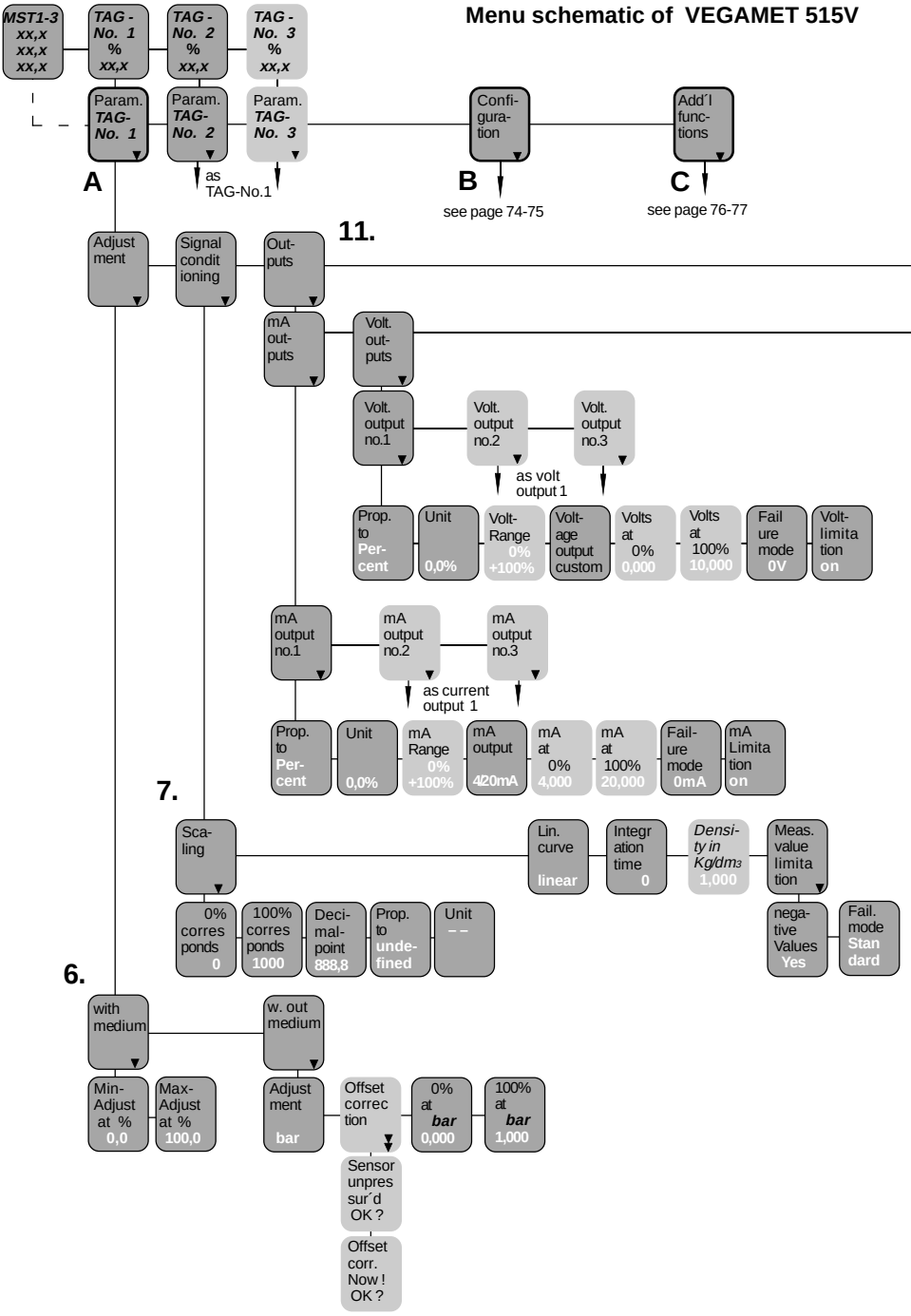
10. Conditioning/Scaling of the sensor display

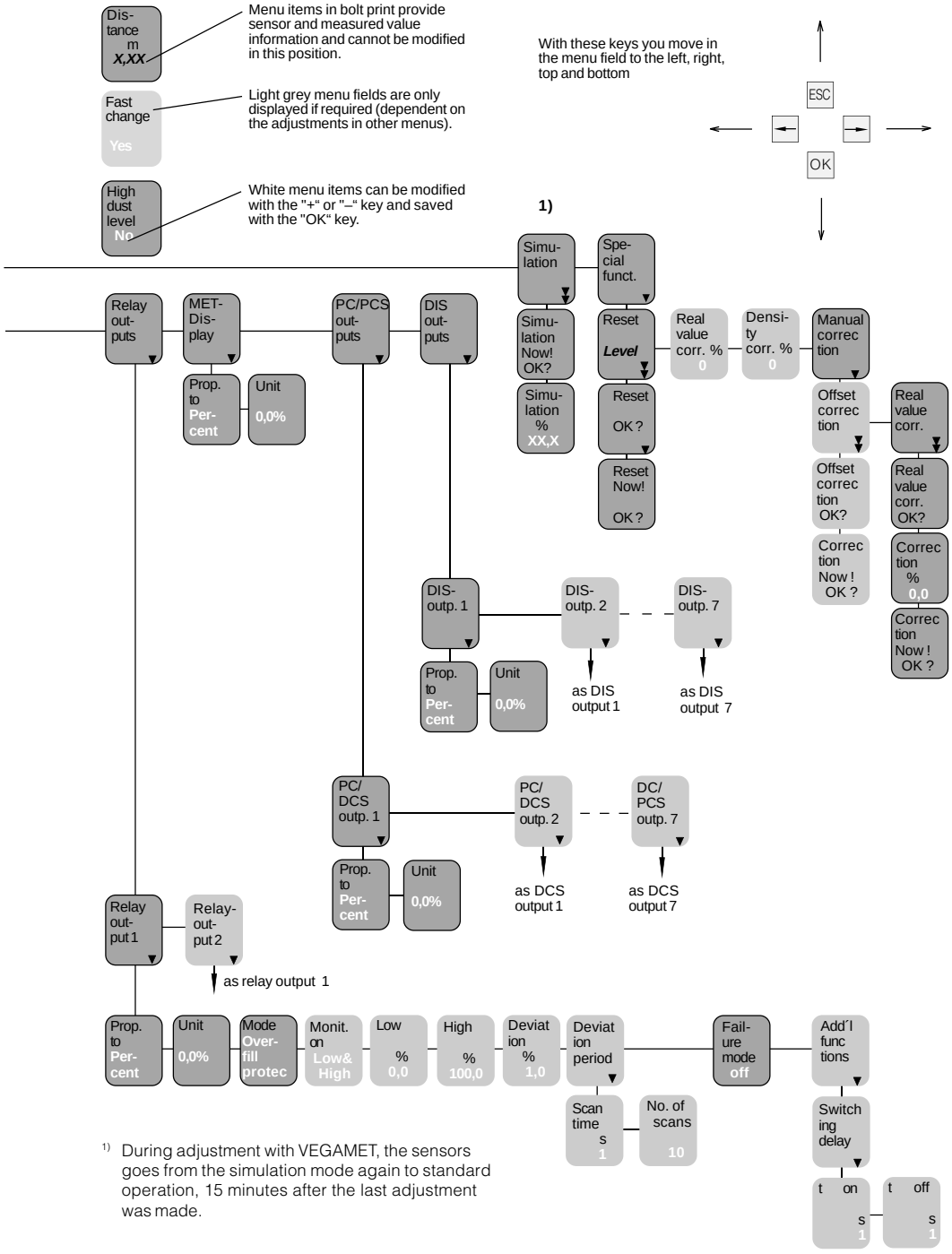
(see menu schematic page 78 (74))

11. Outputs

(see menu schematic page 72)

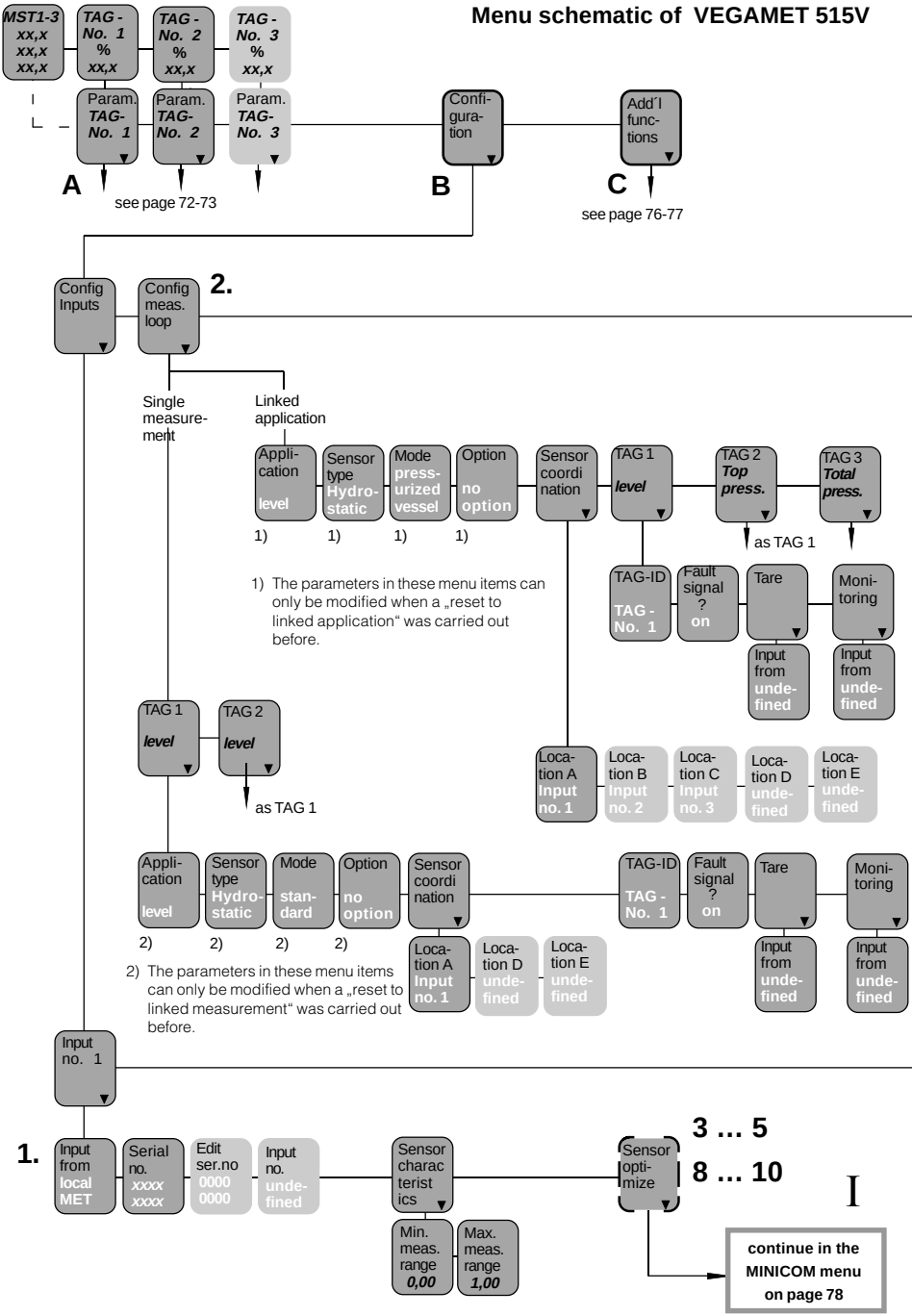
Menu schematic of VEGAMET 515V

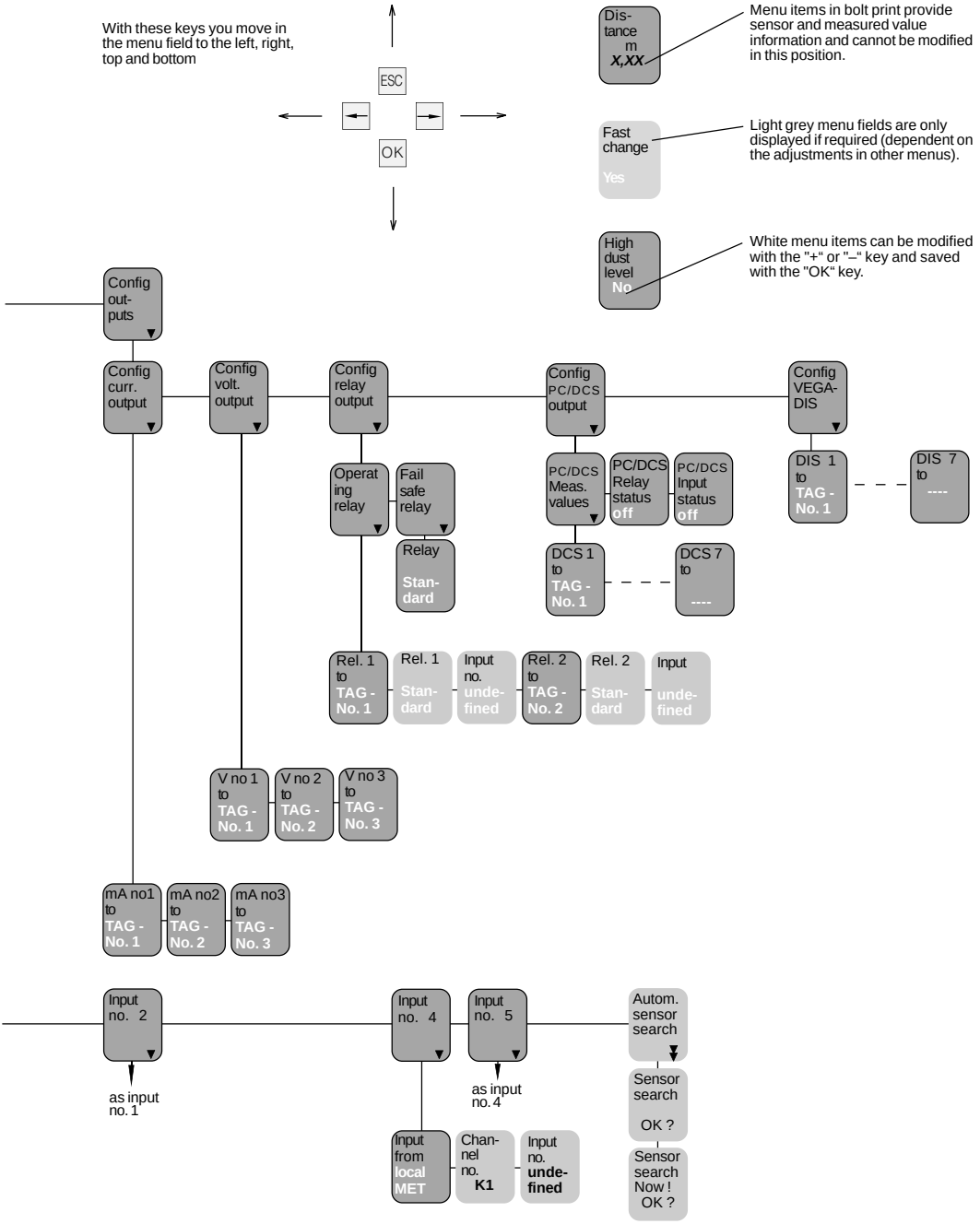




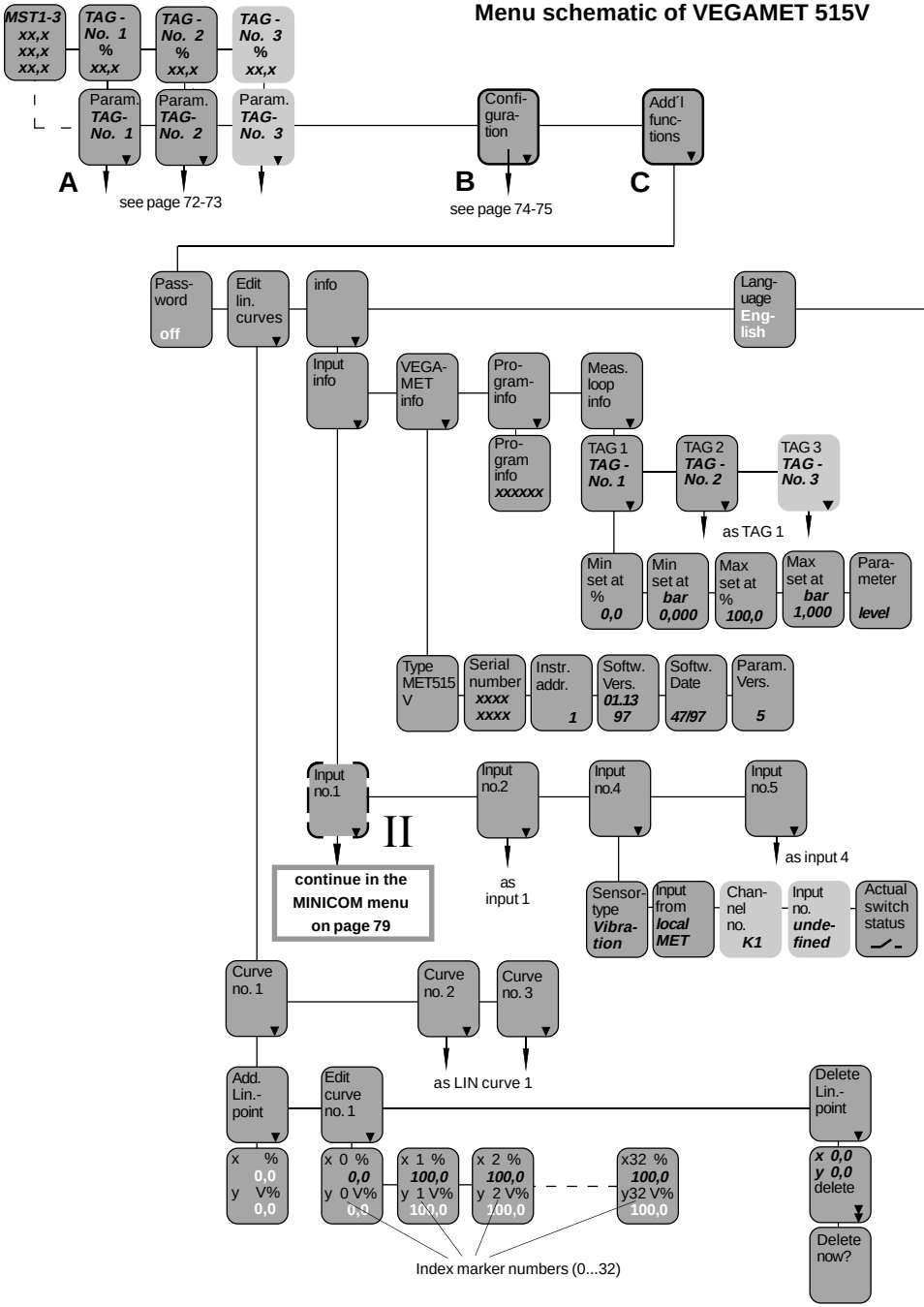
[1] During adjustment with VEGAMET, the sensors goes from the simulation mode again to standard operation, 15 minutes after the last adjustment was made.

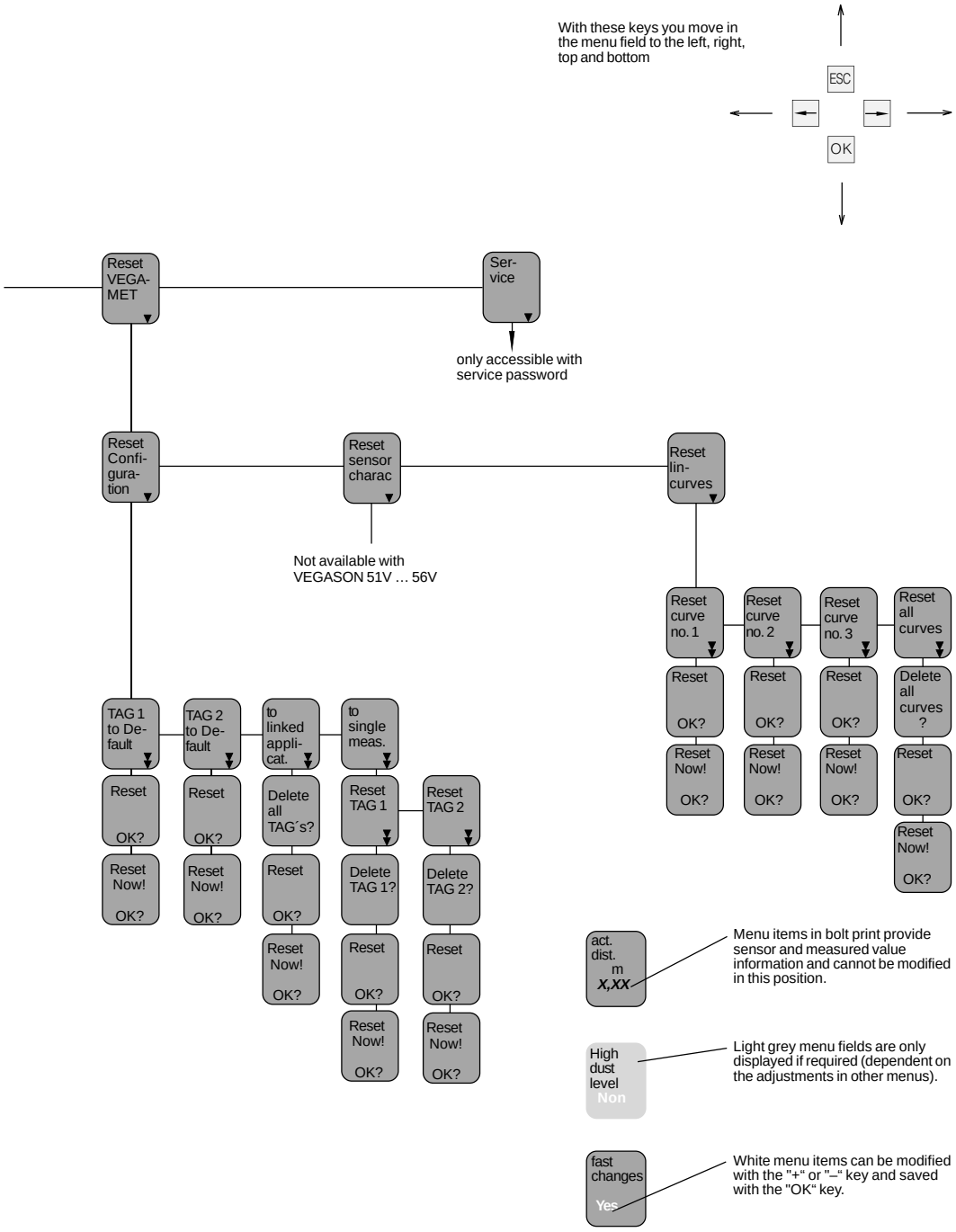
Menu schematic of VEGAMET 515V



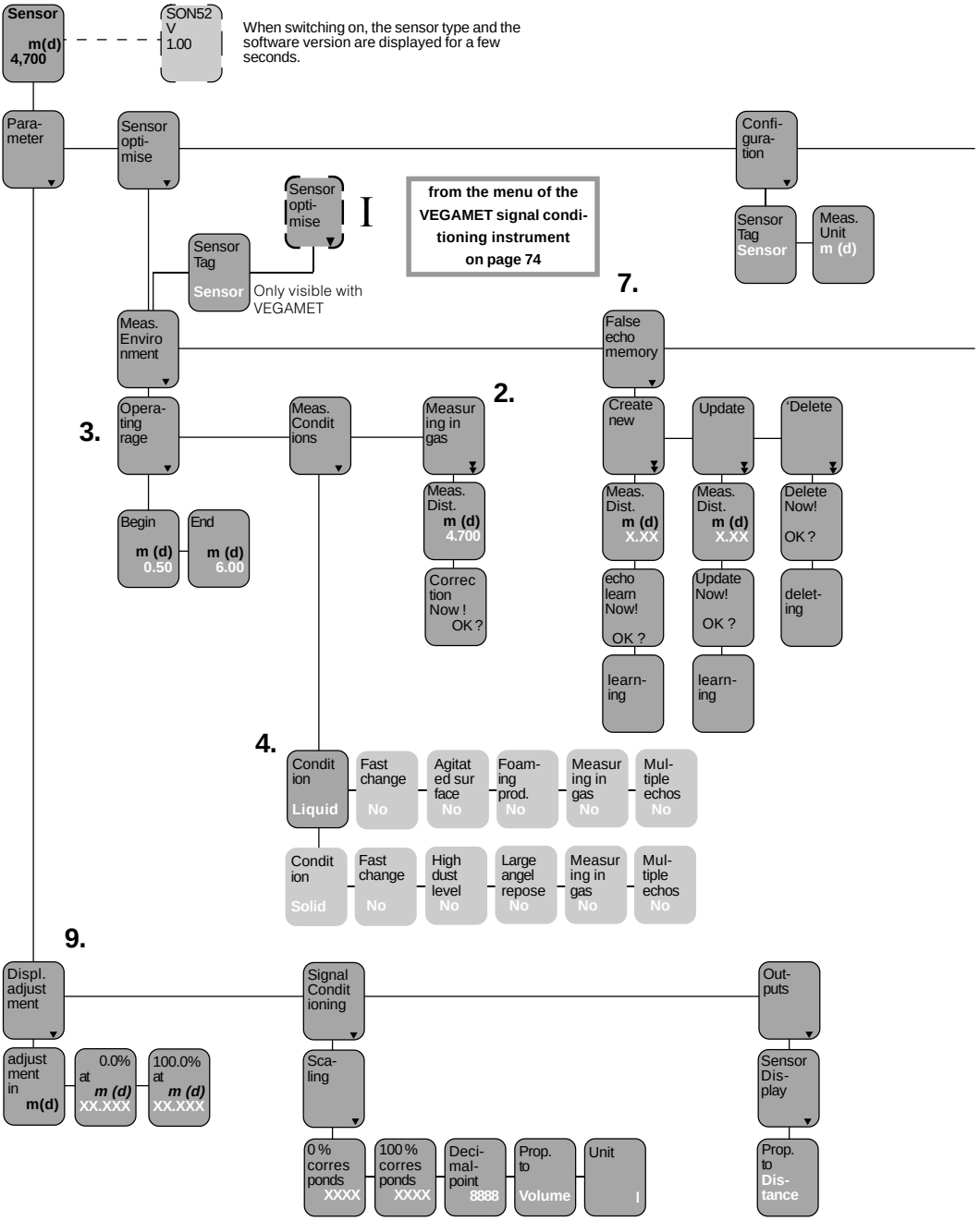

With these keys you move in the menu field to the left, right, top and bottom
ESC
OK
Dis-tance m X,XX
Menu items in bolt print provide sensor and measured value information and cannot be modified in this position.
Fast change Yes
Light grey menu fields are only displayed if required (dependent on the adjustments in other menus).
High dust level No
White menu items can be modified with the "+" or "–" key and saved with the "OK" key.
Config out-puts
Config curr. output
Config volt. output
Config relay output
Config PC/DCS output
Config VEGA-DIS
Operat ing relay
Fail safe relay
Relay Stan-dard
PC/DCS Meas. values
PC/DCS Relay status off
PC/DCS Input status off
DCS 1 to TAG - No. 1
DCS 7 to ----
DIS 1 to TAG - No. 1
DIS 7 to ----
Rel. 1 to TAG - No. 1
Rel. 1 Stan-dard
Input no. unde-fined
Rel. 2 to TAG - No. 2
Rel. 2 Stan-dard
Input unde-fined
V no 1 to TAG - No. 1
V no 2 to TAG - No. 2
V no 3 to TAG - No. 3
mA no1 to TAG - No. 1
mA no2 to TAG - No. 2
mA no3 to TAG - No. 3
Input no. 2
as input no. 1
Input no. 4
Input no. 5
as input no. 4
Input from local MET
Chan-nel no. K1
Input no. unde-fined
Autom. sensor search
Sensor search OK ?
Sensor search Now ! OK ?

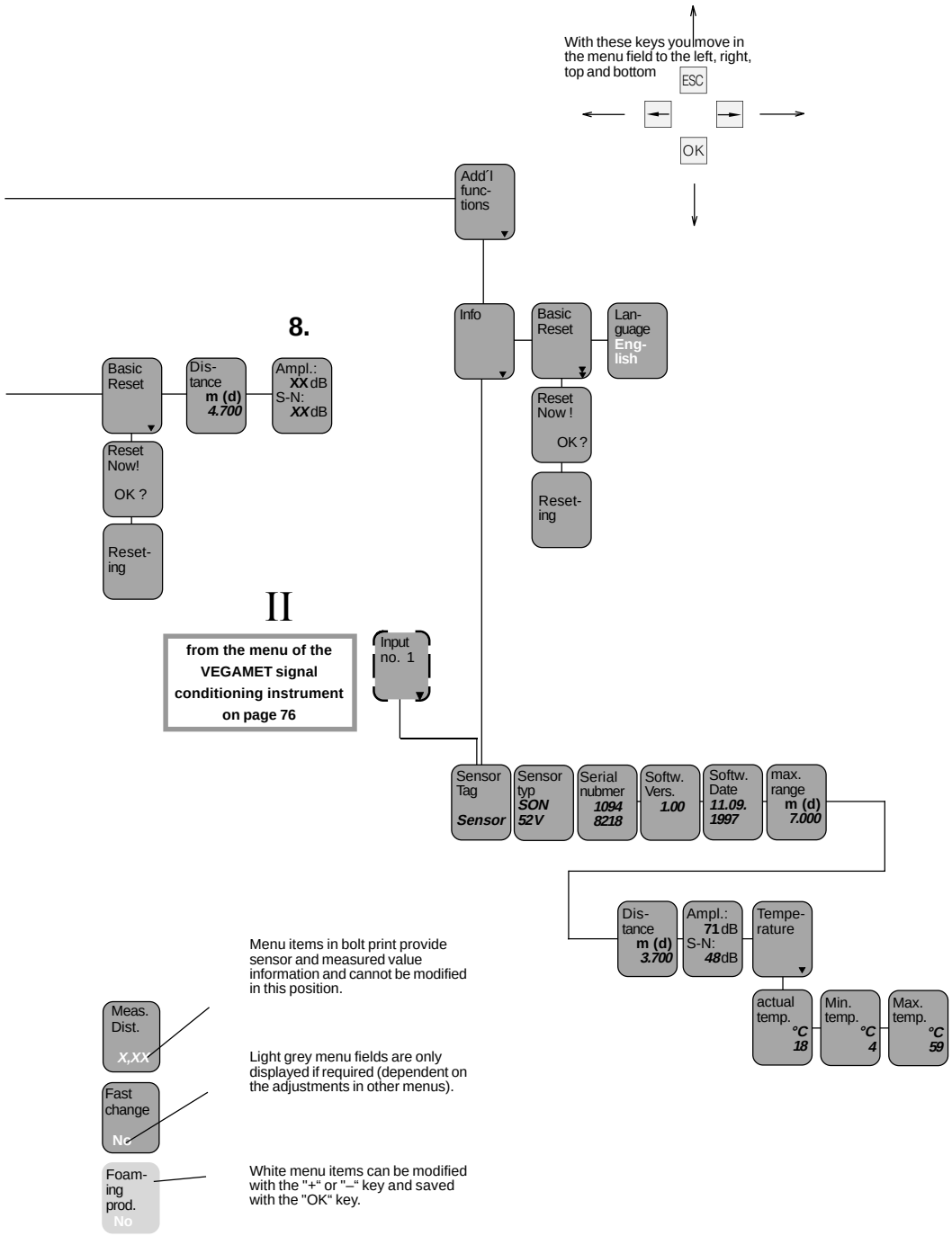
Menu schematic of VEGAMET 515V




With these keys you move in the menu field to the left, right, top and bottom
ESC
OK
Reset VEGA-MET
Ser-vice
only accessible with service password
Reset Confi-gura-tion
Reset sensor charac
Not available with VEGASON 51V ... 56V
Reset lin-curves
Reset curve no. 1
Reset curve no. 2
Reset curve no. 3
Reset all curves
Reset OK?
Reset Now! OK?
Delete all curves ?
TAG 1 to De-fault
TAG 2 to De-fault
to linked appli-cat.
to single meas.
Delete all TAG´s?
Reset TAG 1
Reset TAG 2
Delete TAG 1?
Delete TAG 2?
act. dist. m X,XX
Menu items in bolt print provide sensor and measured value information and cannot be modified in this position.
High dust level Non
Light grey menu fields are only displayed if required (dependent on the adjustments in other menus).
fast changes Yes
White menu items can be modified with the "+" or "–" key and saved with the "OK" key.

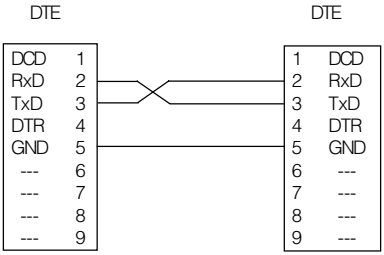
Menu schematic of the adjustment module MINICOM




With these keys you move in the menu field to the left, right, top and bottom
ESC
OK
Add´l functions
Info
Basic Reset
Language English
Reset Now ! OK ?
Reset-ing
8.
Basic Reset
Distance m (d) 4.700
Ampl.: XX dB
S-N: XX dB
Reset Now! OK ?
Reset-ing
II
from the menu of the VEGAMET signal conditioning instrument on page 76
Input no. 1
Sensor Tag Sensor
Sensor typ SON 52V
Serial nubmer 1094 8218
Softw. Vers. 1.00
Softw. Date 11.09. 1997
max. range m (d) 7.000
Distance m (d) 3.700
Ampl.: 71 dB
S-N: 48 dB
Tempe-rature
actual temp. °C 18
Min. temp. °C 4
Max. temp. °C 59
Menu items in bolt print provide sensor and measured value information and cannot be modified in this position.
Meas. Dist. X,XX
Light grey menu fields are only displayed if required (dependent on the adjustments in other menus).
Fast change No
Foam-ing prod. No
White menu items can be modified with the "+" or "–" key and saved with the "OK" key.

6.4 Adjustment with the PC on VEGALOG

For connection of the PC to the VEGALOG processing system, a standard RS 232 DTE-DTE (Data Terminal Equipment) interface cable is required. Connect the PC with the cable to the processing system.



Beside the measured values, also adjustment signals are transmitted digitally between sensor and processing system via the signal and supply cable. The adjustment program VVO can then communicate with the processing system and all connected sensors. In chapter „2.4 Configuration of measuring systems“ the connection of the PC to the different configurations is shown.

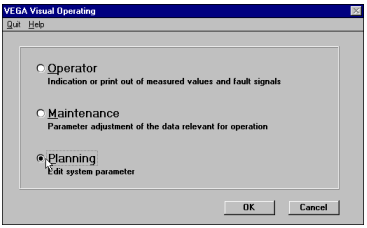
The individual adjustment steps are marked in the following with a dot.
Example:
- Choose …
- Start …
- Click to …

The first steps of the setup wit the PC in conjunction with the VEGALOG processing system correspond to the adjustment in chapter „6.3 Adjustment with VEGAMET or MINICOM“.

- Connect the standard interface of your PC by the standard RS 232 interlink cable (9-pole) to the VEGALOG processing system.
- Now switch on the power supply of the processing system.

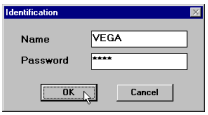
After approx. 1 … 2 minutes (selftest) the measuring system consisting of processing system and sensors is in operating condition and the sensors display measured values. i

- Now start the adjustment software VVO on your PC.



- Choose with the arrow keys or the mouse the item "*Planning*“ on the entrance screen and click to „*OK*“.

In the next window, you are asked for the user identification.

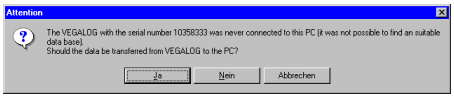


- Enter under name "*VEGA*“.
- Also enter "*VEGA*“ under password.

The adjustment program VEGA Visual Operating (VVO), called in the following VVO, gets into contact with the connected sensor and indicates after a few seconds if and with which sensor a connection exists.

Note:
If you make no connection with the sensor, check the following:
- Is the processing system being supply with supply voltage?
- Do you inadvertently use a wrong RS 232 cable instead of the VEGA RS 232 connection cable?

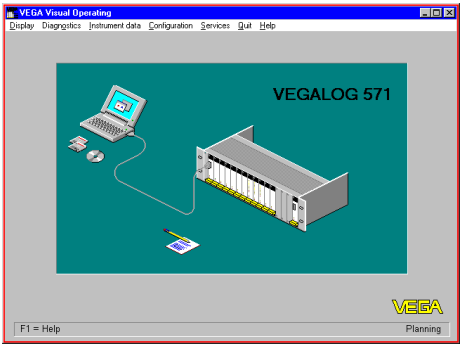
If VVO (adjustment software) gets in contact with the processing system for the first time, you will be asked if you want to transfer the data from the processing system to the PC.



- Click to „*Yes*“.

If connecting the VVO to a VEGALOG from which data has already been saved, you are asked if the saved data should be transferred from the PC to VEGALOG or the data from VEGALOG to the PC.

- Click to „*OK*“ and you are in the main menu window.



The preadjusted user identification can be modified at a later time in the menu „*Configuration/Program/User access*“.

Independent whether you set up a measuring system (unit consisting of sensor and VEGAMET signal conditioning instrument or VEGALOG processing system) with the adjustment software VVO or with the signal conditioning instrument, the adjustment procedure is always the same:
- first of all crease a measurement loop and configure a measuring system in the menu „*Configuration*“ and then
- carry out the parameter adjustment of the sensor in the menu „*Instrument data*“.

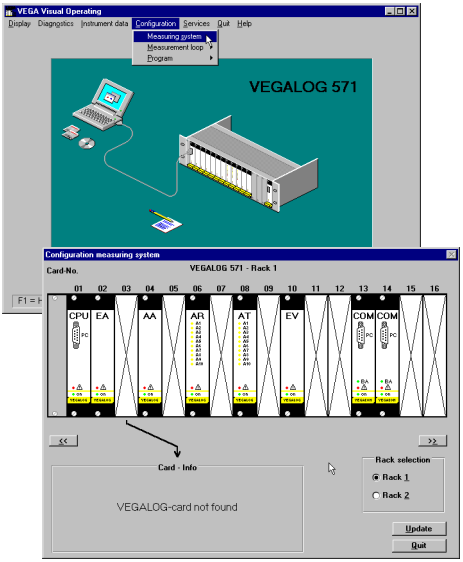
Configuration

The adjustment of an ultrasonic sensor with the PC on a VEGALOG generally corresponds to the adjustment of an ultrasonic sensor on the signal conditioning instrument, as in chapter „6.2 Adjustment with the PC on VEGAMET“.

The only difference is the increased configuration requirement of VEGALOG. A number of possible sensor inputs and signal output as well as different processing routines must be assigned. First of all it must be defined where and what processing which sensor (input) does.

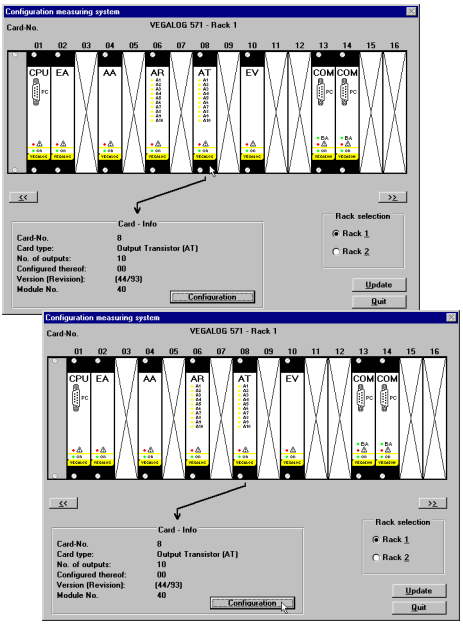
Configurations info

- Choose the menu „*Configuration/Measuring system*“.



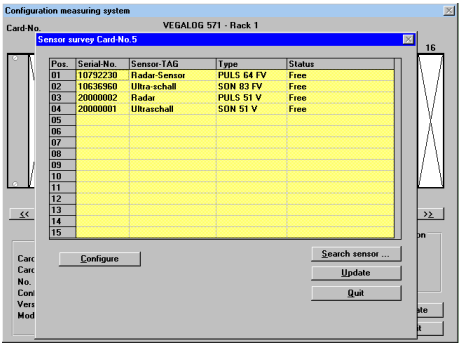
You now reach the menu „*Configuration Measuring system*“, in which an image of the VEGALOG connected to the PC is displayed.

- Click to an individual card number and you will get a „Card info“ in the window.



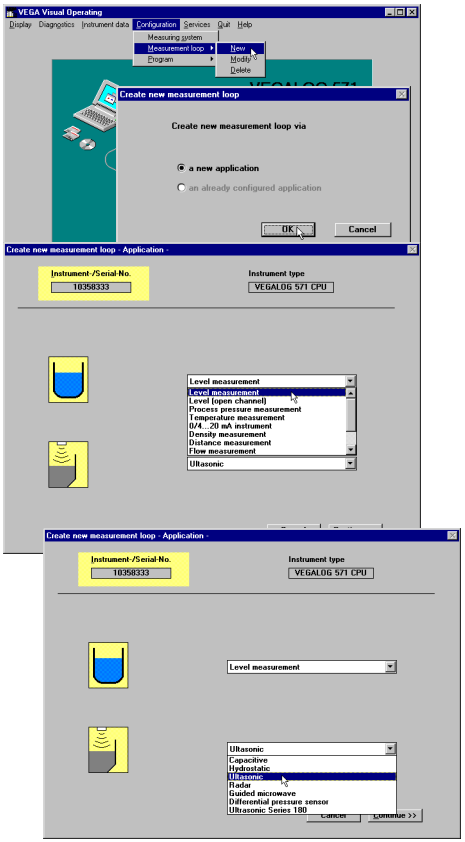
- Click in the card info window of your EV card (input card VBUS) to „*Configuration/ Measuring system*“.

You get an overview of the sensors connected to the card.



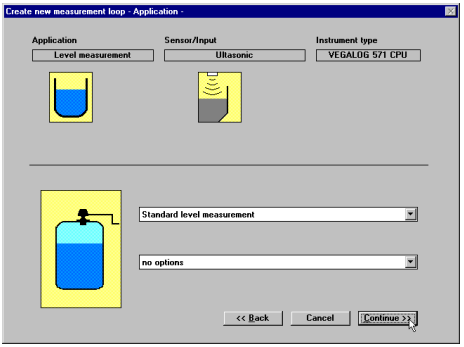
Create new measurement loop

- Choose the menu „*Configuration/Measurement loop/New*“.



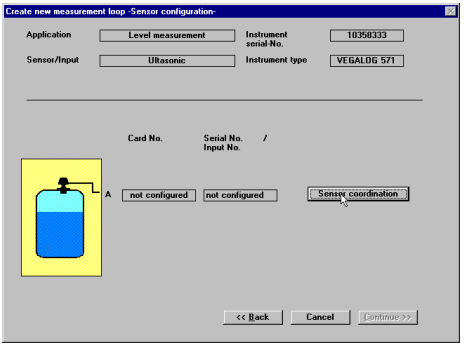
You are in the menu window „*Create new measurement loop - Application*“. Choose the parameter (level measurement, gauge or distance) and the sensor type (Pulse Echo for ultrasonic).

- Choose „*Level measurement*“ and „*Pulse Echo*“.
- Click to „*Continue*“.



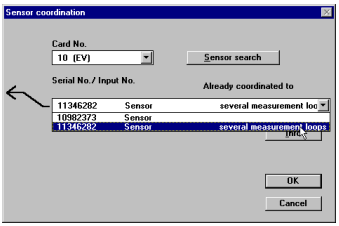
- Choose in the next menu window „Standard level measurement“ and „*no options*“.
- Click to „*Continue*“.

After a few seconds, the menu window „*Create new measurement loop - Sensor configuration*“ opens.

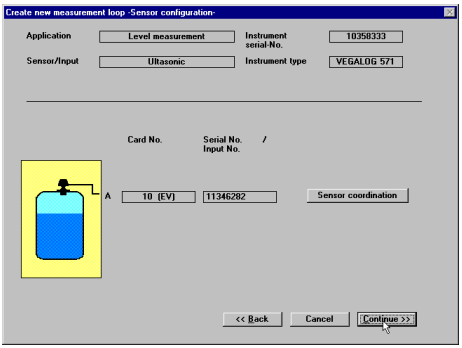


- Click to „*Sensor coordination*“.

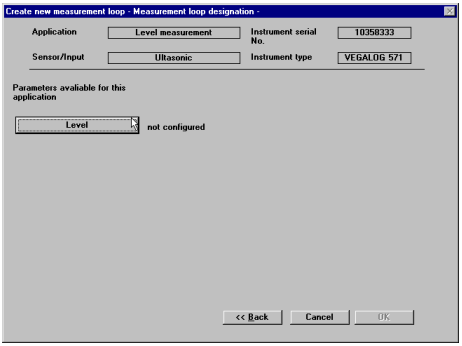
The small menu window „*Sensor coordination*“ opens.



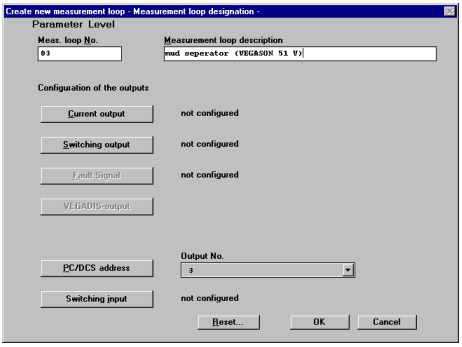
- Choose the serial number of the sensor you want to coordinate and confirm with „*OK*“.



- Click in the menu window „*Create new measurement loop - Sensor configuration*“ to „***Continue***“.
- Click in the menu window „*Create new measurement loop - Measurement loop designation*“ to „***Level***“.



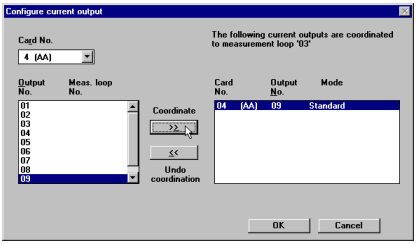
The menu window „*Create new measurement loop - Measurement loop designation*“ opens.



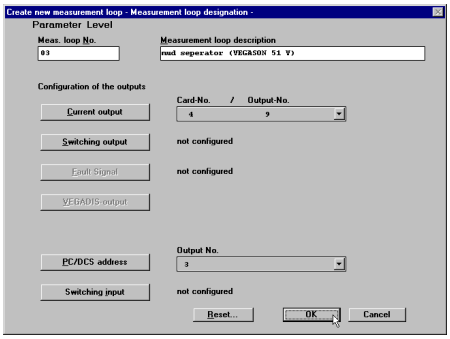
Enter:
- a measurement loop number
- a measurement loop description
- allocate one or several output signals to your sensor.

- For example, configure a current output by clicking to „***Current output***“.

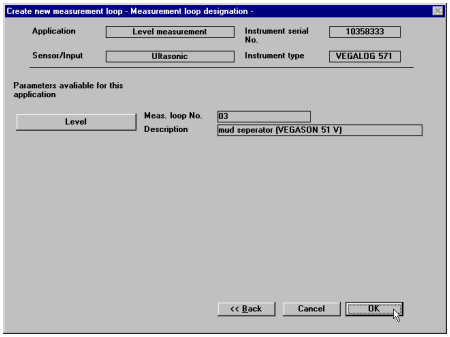
In the menu window „*Configure current output*“ you choose a current output card in your VEGALOG and allocate one or several current outputs to the sensor.



- Confirm your adjustment with „*OK*“ and you are again in the window „*Create new measurement loop - Measurement loop designation*“.



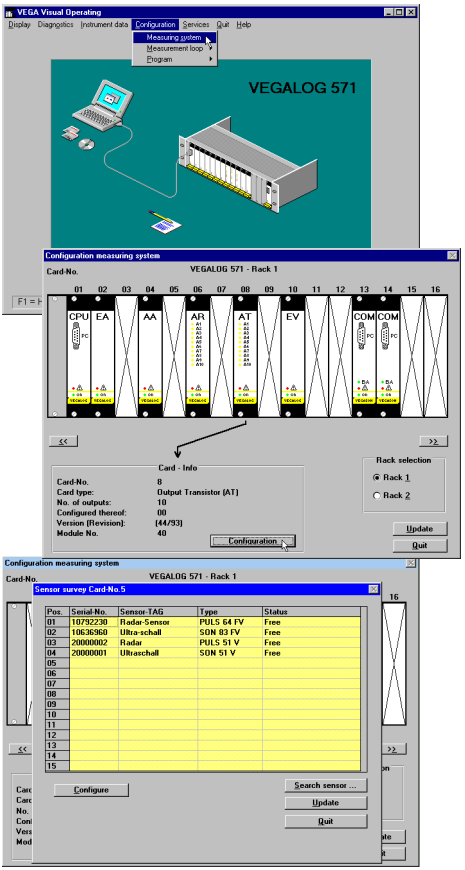
- Confirm your adjustments with „*OK*“.



- Click to „*Quit*“ and you are again in the initial menu.

You have carried out the special additional configuration settings in conjunction with a VEGALOG.

In the menu „*Configuration/Measuring system*“ you now see that one sensor is configured.



Now you have to carry out the parameter adjustment for the sensor. The parameter adjustment is nearly identical with the parameter adjustment in chapter „6.2 Adjustment with the PC on VEGAMET“.

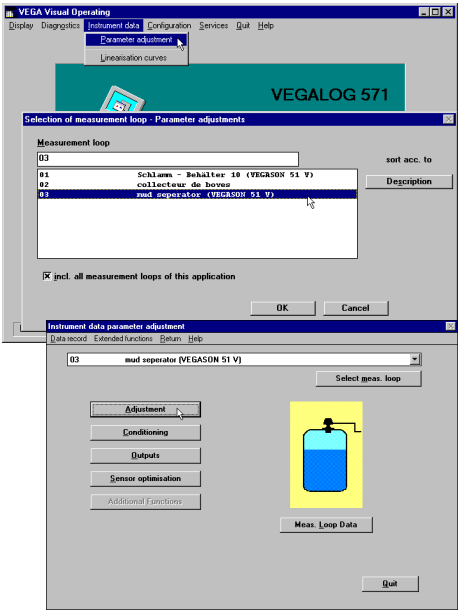
Parameter adjustment

In the menu „*Instrument data/Parameter adjustment*“ you carry out all important sensor settings.

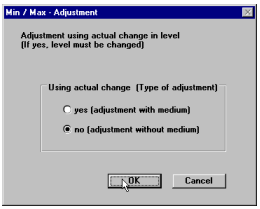
Adjustment

- Choose the menu „***Instrument data/Parameter adjustment***“ and then the sensor for which you want to carry out the parameter adjustment.

In the header of the opening menu window, you see the previously entered measurement loop name and the measurement loop description. If you have configured only one sensor on the signal conditioning instrument, only a choice of one sensor will be offered.



- First choose „***Adjustment***“.
- Click in the menu window „*Adjustment*“ to „***Min/Max-Adjustment***“.



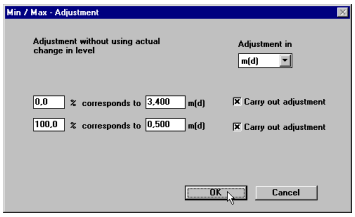
You can carry out the min./max. adjustment *"with medium"* (adjustment by means of the actual level) or *"without medium"* (without taking the actual level into consideration, i.e. with empty vessel).

Generally, you will carry out the adjustment without medium. Then you are not concerned about the actual vessel filling during adjustment. When you want to carry out the adjustment with medium, you have to carry out the min. adjustment with emptied (also partly emptied) vessel and the max. adjustment with filled (also partly filled) vessel. It is convenient and quick to carry out the adjustment without medium, as shown in the example.

- Choose "***no (adjustment without medium)***".
- Choose if you want the carry out the adjustment in *meters* (m) or in *feet* (ft).
- Enter a distance for the upper and lower level and the volume in % corresponding to each distance.

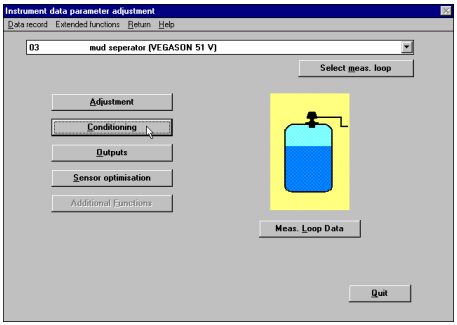
In the example, the 0 % filling is at a product distance of 3.400 m and the 100 % filling at a product distance of 0.500 m.

Note:
The sensor can only detect levels within the defined operating range. For the detection of levels outside the operating range, e.g. new adjustment, it is necessary to correct the operating range in the menu "*Sensor optimisation/Meas. environment*“.



- Confirm your adjustments with "*OK*" and you are again in the menu window "*Adjustment*".
- Click in the menu window "*Adjustment*" to "*Quit*".

You are again in the menu window "*Instrument data parameter adjustment*".



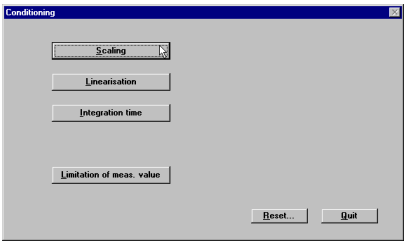
Now the sensor electronics has two characteristics points, one for min. and one for max., out of which a linear correlation between product distance and the percentage filling of a vessel is generated. Naturally the characteristics point must not be at 0 % and 100 %, however the distance should be as big as possible (e.g. at 20 % and at 80 %). The difference between the characteristics points for the min./max. adjustment should be at least 50 mm product distance.

This is a theoretical value, because if the characteristics points are too close together, the possible measuring error increases. Ideal would be, to carry out the adjustment as shown in the example, at 0 % and at 100 %.In the menu "*Instrument data/Parameter adjustment/Conditioning/Linearisation*" you can enter later, if necessary, a correlation between product distance and percent value of volume other than linear (see later subitem linearisation).

Conditioning

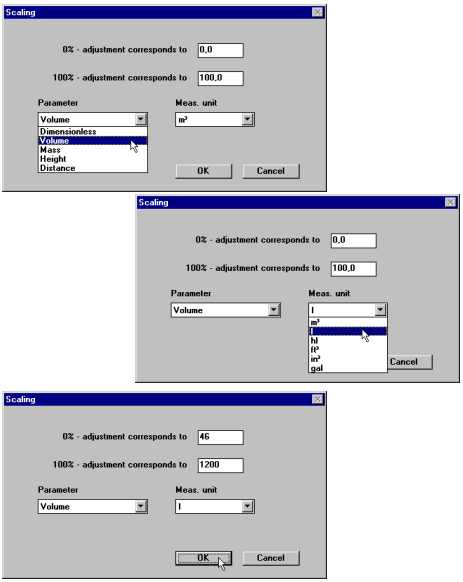
- Click in the menu window "*Instrument data parameter adjustment*" to "*Conditioning*".

The menu window "*Conditioning*" opens.



- Click to "*Scaling*".

In the menu "*Scaling*" you enter the actual 0 % and 100 % values of the parameter and their unit. You thereby inform the sensor, e.g. that at 0 % filling there are still 45 liters and at 100 % filling 1200 liters in the vessel. The sensor display then shows with empty vessel (0 %) 45 liters and with full vessel (100 %) 1200 liters.



As parameter you can choose *"dimensionless* (plain numbers), *volume, mass, height and distance"* and assign an appropriate measuring unit (e.g. l, hl). The sensor display then shows the measured value in the selected parameter and unit.

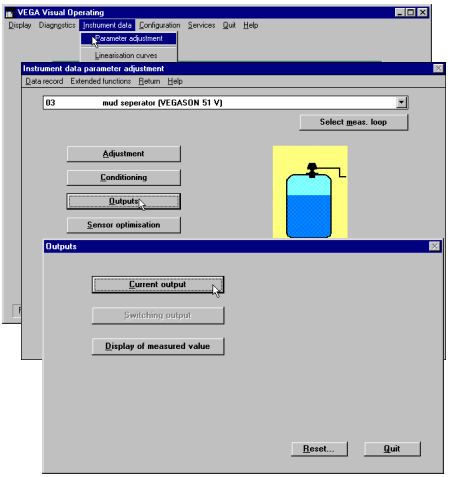
- Save the adjustments in the menu "*Scaling*" by clicking "***OK***".

The adjustments are now transferred to the sensor and you are again in the menu window "*Conditioning*".

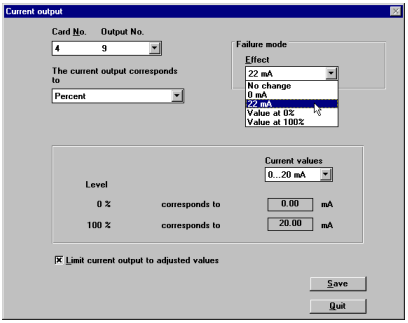
- Click in the menu window „*Conditioning*" to „***Quit***".
- Click in the menu window „*Instrument data parameter adjustment*" to „***Quit***".

Outputs

- Choose in the main menu window „***Instrument data/Parameter adjustment***" and then the menu item „***Outputs***".



- Click in the menu window „*Outputs*" to „***Current output***", to adjust the signal condition of the 0/4…20 mA output signal.



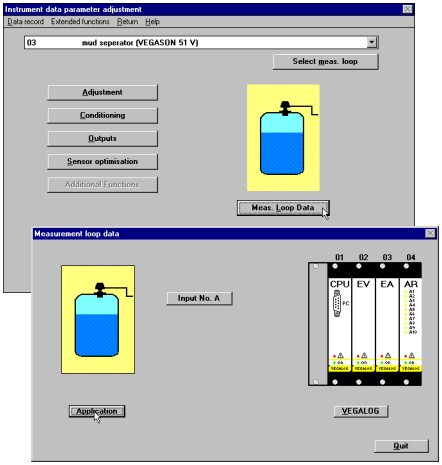
- If you have made adjustments in the menu window „*Current output*", click to „***Save***".
- If you want to keep the adjustments unchanged, click to „***Quit***".

You are again in the menu window „*Outputs*“. With the menu item „***Display of measured value***“ you scale the sensor display or probably further indicating instruments connected to VEGALOG (see also „6.2 Adjustment with the PC on VEGAMET“).

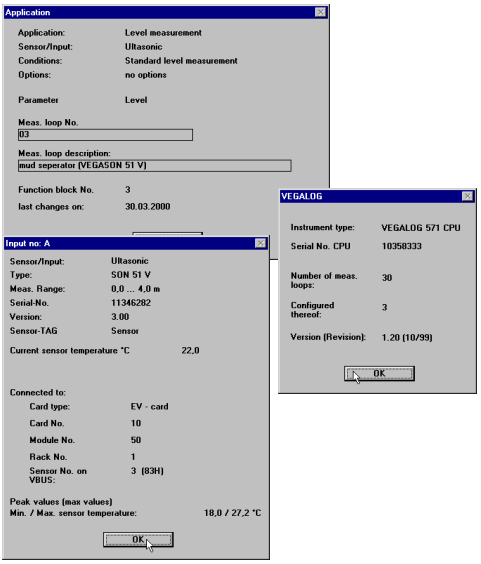
- Click in the menu window „*Outputs*“ to „***Quit***“ and you are in the menu window „*Instrument data parameter adjustment*“.
- Click in the menu window „*Instrument data parameter adjustment*“ again to „***Quit***“.

Meas. loop data

- Click in the window „*Instrument data parameter adjustment*“ to „***Meas. loop data***“.



- Click to „***Application***“, „*Input no. A*“ and „*VEGALOG*“, to get in the information windows detailed information on your measuring system.

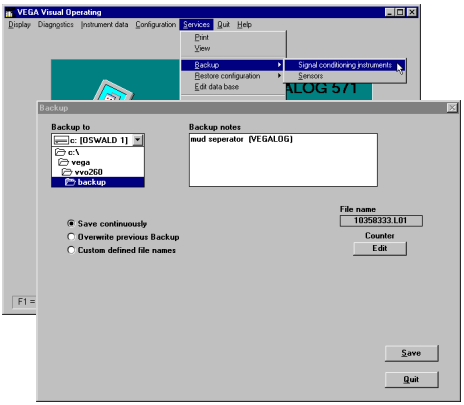


- Close the information window.
- Quit the menu „*Meas. loop data*“.
- Click in the menu window „*Instrument data parameter adjustment*“ to „***Quit***“.

You are again in the main menu window.

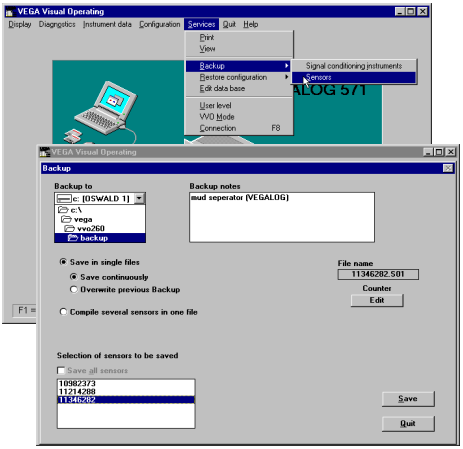
Backup

- Click to „*Services/Backup/Signal conditioning instruments*“.



In the menu field „*Backup*“ the VEGALOG with the serial number is displayed. You can save the data of VEGALOG individually or in groups with all settings in any directory on your PC. It is also possible to add small notes to each backup.

Furthermore you can save the settings of the sensors:

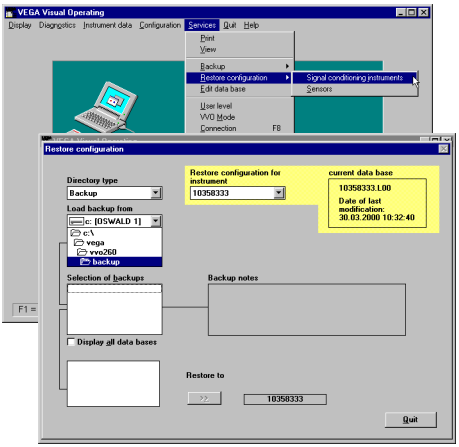


Saved sensor data can be transferred to other sensors at a later time.

If e.g. you have a system with several of the same storage vessels and identical sensors, it is sufficient, to configure one sensor, to save the settings and then transfer them to the other sensors.

The same is naturally valid for the VEGALOG processing system.

- Choose the menu „*Services/Restore configuration/Signal conditioning instruments*“.



In the yellow window cutout, you choose a VEGALOG (or a sensor) which should be overwritten with the settings of another VEGALOG.

Choose in the field „*Selection of backup*“ the serial number of the VEGALOG of which you want to take over the settings. With „*Restore after*“ you transfer these VEGALOG settings to the VEGALOG you have chosen in the yellow window cutout.

Linearisation

See chapter „6.2 Adjustment with the PC on VEGAMET“ under „Linearisation“.

Simulation

See chapter „6.2 Adjustment with the PC on VEGAMET“ under „Simulation“.

Change COM interface

See chapter „6.2 Adjustment with the PC on VEGAMET“ under „Change COM interface.

Show measured value

See chapter „6.2 Adjustment with the PC on VEGAMET“ under „Show measured value“.

7 Diagnostics

7.1 Simulation

For simulation of a certain filling, you can call up the function "Simulation“ on the adjustment module MINICOM, in the software program VVO or on the signal conditioning instrument.

You simulate a vessel filling and thereby a certain sensor current. Please note that connected instruments, such as e.g. a PLC react according to their adjustments and will probably activate alarms or system functions.

Simulation with VVO
If you start the simulation mode with the adjustment program VVO on the PC, the simulated level is outputted until you quit the simulation mode.

Simulation with VEGAMET
If you call up the simulation mode with the adjustment keys on the signal conditioning instrument, 15 minutes after the last adjustment, the signal conditioning instrument returns again to standard operating condition.

Simulation with MINICOM
If you start the simulation mode on the adjustment module MINICOM, the sensor returns to standard operating mode after one hour.

7.2 Error code

Error code	Rectification
E013 No valid measured value - Sensor in the warm-up phase - Loss of the useful echo	Message is displayed during warm-up phase If the message remains, a false echo storage must be made with the adjustment module MINICOM in the menu “sensor optimisation” or better, with the PC and VVO. If the message still remains, carry out a new adjustment.
E017 Adjustment span too small	Carry out a readjustment. Make sure that the difference between min. and max. adjustment is at least 10 mm.
E036 Sensor software does not run	Sensor must be programmed with new software (service). Message appears during a software update.
E040 Hardware failure/Electronics defec-	Check all connection cables. Transducer defective. Contact our service department.

VEGA

VEGA Grieshaber KG
Am Hohenstein 113
D-77761 Schiltach
Phone (0 78 36) 50 - 0
Fax (0 78 36) 50 - 201
e-mail info@vega-g.de
internet www.vega-g.de

ISO 9001

The statements on types, application, use and operating conditions of the sensors and processing systems correspond to the latest information at the time of printing.

Technical data subject to alterations